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ABSTRACT

The information in this supplementary notebook is intended to provide teachers with additional materials, ideas and suggestions, and activities to help in implementing the first 21 units of the Applied Mathematics modules that help develop and refine job-related mathematics skills. An introduction lists the 36 units of the complete Applied Mathematics curriculum developed by the Center for Occupational Research and Development (in Waco, Texas) and a consortium of states. Each unit contains a video that relates the unit topic to the world of work, written material, hands-on laboratory activities, and word problems; cooperative learning; and the teacher's role in cooperative learning. Types of materials and activities provided in this notebook include word problems, review sheets, and study guides. Unit topics are as follows: getting to know the calculator; naming numbers in different ways; finding answers with calculators; problem solving techniques; estimating answers; English and metric units; graphs, charts, and tables; dealing with data; working with lines and angles; shapes in two and three dimensions; ratios and proportions; scale drawings; signed numbers and vectors; scientific notation; precision, accuracy, and tolerance; solving practical problems with powers and roots; using formulas to solve practical problems; solving problems that involve linear and nonlinear equations; graphing data; statistics; probabilities; and using right-triangle relationships. A teaching supplement contains lab activities, quizzes, review sheets, study guides, video activities, and work sheets. (YLB)

FLORIDA TEACHING SUPPLEMENT

Applied Mathematics

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Bureau of Career Development and Educational Improvement
Division of Vocational, Adult, and Community Education
Department of Education
Florida Education Center
Tallahassee, FL 32399
(904) 488-0400

FLORIDA TEACHING SUPPLEMENT

Applied Mathematics

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September 1991

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INTRODUCTION

Vocational training and academic education, once viewed as two separate segments of the educational system, have now achieved a mutually beneficial partnership through an integrated new instructional approach called the Applied Curriculum. The Applied Mathematics instructional materials, funded and developed by a consortium of states and Canadian provinces in association with the Center for Occupational Research and Development, have been used in Florida for several years. These modularized materials have been used successfully to teach mathematics skills applicable to the workplace.

Building on this positive experience with the instructional materials, the Florida DVACE decided that a special teaching supplement should be developed to enhance or supplement the already well-designed materials. This document was drafted by a writing team of experienced applied mathematics teachers.

BACKGROUND

Twentieth-century technology and, in particular, technological advances of this decade calls for a close examination of the math skills currently being taught in the classroom. More important than the skill areas addressed in the school curricula today are the assimilation factor and subsequent use of materials designed to enhance math skills. Ultimately, educators must respond to this question: Are the math skill areas as stressed in a standard curriculum practical enough to sustain the high school graduate in the world of work today?

The demands on individuals in the work force today are as diverse as the people themselves—demands that call for a new type of command as the economic climate shifts from an agrarian to an information-based economy. Jobs once handled by a single farm or small-business family are now relegated to others on a multitude of levels. Today's world calls for people skilled in the art of communication to compute and solve problems in various ways. In an information-based workplace, these skills are used daily. It is essential that students be skilled in those areas that will enable them to work in an environment where each person must be able to solve problems as necessary to complete a job. How, then, can educators today enhance the math and problem-solving skills needed to meet tomorrow's demands in the workplace?

Vocational training, once thought of as a separate segment of education, has been the focus of a new integrated program called Applied Mathematics. Its purpose: to teach math skills in a vocational setting by introducing students to a modular learning experience based on skill development applicable to the workplace. The materials were funded and developed by a consortium of state and provincial education agencies, in association with the Center for Occupational Research and Development (CORD).

WHAT IS APPLIED MATHEMATICS?

Applied Mathematics is a set of modular learning materials prepared to help develop and refine job-related mathematics skills. Its focus is on doing arithmetic operations with calculators, solving problems, estimating answers, and developing measurement skills. Topics include geometry, data handling, simple probability and statistics, simple trigonometry, algebraic formulas, quality assurance/quality control, and solving problems with computers. *Applied Mathematics* engages students in classroom, laboratory, and campus-wide experiences that require "hands-on" application of math skills.

Each of the 36 units contains a video that relates the unit topic to the world of work; written material covering mathematical principles with examples and study activities; three hands-on laboratory activities that require measurement, calculations, and interpretation of results; and approximately 40 word problems that sharpen problem-solving skills and require the use of scientific calculators.

Teachers using *Applied Mathematics* will utilize a variety of teaching styles to keep students involved in their learning. Pilot-site teachers indicate that extensive use of cooperative learning strategies has had a positive impact on daily lessons.

The 36 units of *Applied Mathematics* were developed and reviewed by a group of mathematics and vocational educators, with input and reactions from business and industry representatives. The units, which conform with the standards published by the National Council of Teachers of Mathematics, include:

A: Getting to Know Your Calculator (optional)
B: Naming Numbers in Different Ways (optional)
C: Finding Answers with Your Calculator (optional)
1: Learning Problem-solving Techniques
2: Estimating Answers
3: Measuring in English and Metric Units
4: Using Graphs, Charts, and Tables
5: Dealing with Data
6: Working with Lines and Angles
7: Working with Shapes in Two Dimensions
8: Working with Shapes in Three Dimensions
9: Using Ratios and Proportions
10: Working with Scale Drawings
11: Using Signed Numbers and Vectors
12: Using Scientific Notation
13: Precision, Accuracy, and Tolerance
14: Solving Problems with Powers and Roots
15: Using Formulas to Solve Problems
16: Solving Problems That Involve Linear Equations
17: Graphing Data
18: Solving Problems That Involve Nonlinear Equations
19: Working with Statistics
20: Working with Probabilities

21: Using Right-triangle Relationships
22: Using Trigonometric Functions
23: Factoring
24: Patterns and Functions
25: Quadratics
26: Systems of Equations
27: Inequalities
28: Geometry in the Workplace I
29: Geometry in the Workplace II
30: Computers in Mathematics I
31: Computers in Mathematics II
32: Quality Assurance I
33: Quality Assurance II

Several alternatives are available to the teacher using these modules:

1. Use the modules as the basis for two one-year stand-alone courses called Applied Mathematics I and II. Curriculum frameworks and student performance standards for each course identify the modules to be covered.

2. Infuse the modules into existing mathematics courses. Curriculum frameworks and student performance standards for the existing course must be met.

3. Incorporate the appropriate modules as needed into existing vocational programs. In this mode, certain units and subsections are used to augment vocational studies.

WHO SHOULD TAKE APPLIED MATHEMATICS?

The modules are designed for the average student who has reached an eighth-grade competency level in mathematics and who has an eighth-grade reading level.

CREDIT

When modules are used in a stand-alone course called Applied Mathematics I or II, one mathematics credit is earned for each year. Each credit meets Florida's graduation requirement in mathematics.

CERTIFICATION

Teacher certification in Florida is established and controlled by Florida Statute regulated by State Board rules. (See the State Course Code Directory for specific information.)

CURRICULUM FRAMEWORK AND STUDENT PERFORMANCE STANDARDS

All courses offered in Florida schools must teach toward the intended outcomes established in the curriculum framework and students performance standards for the course.

ASSESSMENT OF STUDENT PROGRESS

When new curriculum materials are introduced, the question arises about the best way to monitor student achievement.

The Applied Mathematics materials and activities lend themselves readily to a variety of measurement strategies. In addition to pre- and posttests, each unit includes checklists and other evaluative tools that may be used by teachers or by students as either peer or self-evaluation instruments.

EQUIPMENT AND MATERIALS

Equipment and materials will be needed for the hands-on activities. Depending on resources already available at the school, the estimated cost range between $1,000 and $3,000. For specific equipment and materials information, contact Betty Jones, Florida Applied Mathematics Consortium Representative, at (407) 849-3200, ext. 2821.

COOPERATIVE LEARNING

The Applied Mathematics materials provide many opportunities for students to work in groups on projects, discussions, or simulations.

The basic elements of cooperative learning include:

Positive Interdependence: Students must feel that they need each other in order to complete the group's task, that they "sink or swim" together. Some ways to create this feeling are through establishing **mutual goals** (students and group members must learn the material), **joint rewards** (all group members must achieve above a certain percentage on the test for each to receive bonus points), **shared materials and information** (one paper for each group or each member receives only part of the information needed to do the assignment), and **assigned roles** (each group member is assigned a role; i.e., summarizer, encourager of participation, elaborator).

Face-to-Face Interaction: No magic exists in positive interdependence in and of itself. Beneficial educational outcomes are due to the interaction patterns and verbal exchanges that take place among students in carefully structured cooperative learning groups. Oral summarizing, giving and receiving explanations, and elaborating (relating what is being learned to previous learning) are important types of verbal interchanges.

Individual Accountability: Cooperative learning groups are not successful until every member has learned the material or has helped with and understood the assignment. Thus, it is important to frequently stress and assess individual learning so that group members can appropriately support each other. Some ways of structuring individual accountability are by giving each group member an individual exam or by randomly selecting one member to give an answer for the entire group.

Interpersonal and Small-Group Skills: Students do not come to school with the social skills they need to collaborate effectively with others. Therefore, teachers need to teach the appropriate communication, leadership, trust, decision-making, and conflict management skills to students and provide the motivation to use these skills so groups can function effectively.

Group Processing: Processing means giving students the time and procedure to analyze how well their groups are functioning and how well they are using the necessary social skills. Processing helps all group members achieve while maintaining effective working relationships among members. Feedback from the teacher and/or student observers on how well they observed the groups working may help processing effectiveness.

The teacher's role in cooperative learning environments involves making decisions, setting tasks and establishing positive interdependence, monitoring and intervening, and evaluating and processing. This role is summarized in the diagram on the next page.

COOPERATIVE LEARNING GROUP ROLES

PRAISER:
Your job is to say something positive about each member's ideas. Try to point out the good rather than the bad.

CHECKER:
Your job is to check to see that everyone understands the assignment or problem.

RECORDER:
Your job is to write down the ideas discussed by all the group members.

ENCOURAGER:
Your job is to get all the members involved in the discussion.

OBSERVER:
Your job is to keep track of how well the group is processing the task.

Decisions

Size of Group

Assigning Students

Arranging the Room

Planning the Materials

Assigning Roles

Monitoring and Intervening

Providing Task Assistance

Monitoring Student Behavior

Intervening

Closure to Lesson

Setting Task & Positive Interdependence

Explaining Task

Structuring Positive Goal Interdependence

Structuring Individual Accountability

Structuring Intergroup Cooperation

Explaining Criteria for Success

Specifying Desired Behaviors

Evaluating and Processing

Evaluating the Quantity and Quality of Student's Learning

Assessing Group Functioning

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HELPFUL HINTS FOR COOPERATIVE LEARNING

1. Prepare the classroom for cooperative behavior.
2. Evaluate what works and what doesn't and why.
3. Don't be afraid to change a student's group placement.
4. Have each group be a microcosm of your classroom.
5. Determine team recognition.
6. Feel free to put a quality control component into the strategies. You have total control.
7. Give the strategies time to work. Be patient and don't give up.

There are many ways to evaluate the cooperative learning groups, one being teacher observation. The following activity might prove helpful.

COOPERATIVE LEARNING ACTIVITY

When a teacher begins using cooperative learning groups, it is important that the class understands the processing of information.

Put one of the following sentences on the board each day. Have the group discuss and finish the sentence.

The most helpful thing anyone did today was . . .

We are really good at . . .

We could do better at . . .

One word we would use to describe how our group worked today is . . .

When someone in our group was not contributing ideas, we . . .

Today we really needed someone to . . .

I really feel good when other members of my group . . .

CONCLUSION

As stated earlier, Applied Curriculum teachers will utilize a variety of teaching styles to keep students actively involved in their learning. Teachers, too, can learn from ***their*** peers and are encouraged to share their "tricks of the trade" with one another. Visiting each others' classrooms, even in other schools or districts, to see how other teachers manage the cooperative learning environment is strongly suggested. By observing successful teaching practices, good experienced teachers will be able to apply new ideas and models to their own situation. With support and encouragement from their administrators, teachers can make cooperative learning better for themselves and their students.

UNIT A: Getting to Know Your Calculator

VIDEO

Data: Shipment consists of the following egg types and prices.

Size	Number	Price per dozen
Jumbo	_____	_____
Extra Large	_____	_____
Large	_____	_____
Medium	_____	_____
Small	_____	_____
Other	_____	_____
Total	_____	

Problem: Jim's cost to produce the eggs is $0.65 per dozen. You are asked to calculate the profit Jim will receive for this shipment.

Procedure: The first step is to change the number of eggs to dozens of eggs. This is done by dividing the number in each size of eggs by twelve.

The next step is to multiply the price per dozen for an egg size by the number of dozen to get the dollar value of each size.

Size	Number of dozen	Dollar value per size
Jumbo	_____	_____
Extra Large	_____	_____
Large	_____	_____
Medium	_____	_____
Small	_____	_____
Other	_____	_____
Total	_____	_____

To calculate the average price per dozen, divide the total dollar value by the total number of dozen.

Average price per dozen = _____ ÷ _____ = _____

To calculate the profit, first find Jim's total cost to produce the eggs. To do this, multiply the average cost by the total number of dozen eggs. Finally, subtract the cost to produce the eggs from the total dollar value Jim was paid for the egg shipment. The remaining money is the profit.

Total = _____ × _____ = _____

Profit = _____ − _____ = _____

Questions

1. If Jim averages the same profit amount for a seven-day period, what is the amount of profit for the week?

2. Based on the weekly profit, what is the annual profit for Jim's business?

3. Is this an acceptable amount of profit?

4. Can you think of any type of work where a calculator is never used?

STUDY GUIDE

Part I

Using calculator keys and the four basic operations (pp. 1–9)

1. You will be operating with several different sets of numbers with the calculator. They are _____, _____, _____, and _____.

2. Describe the four sets of numbers in question 1.

   a._____

   b._____

   c._____

   d._____

3. How do you turn the calculator on? _____

   _____

4. How do you turn the calculator off? _____

   _____

   Will the calculator turn off automatically? If so, under what conditions? _____

   _____

5. Most calculators have more than one key to clear the window. Usually one key clears everything—last entry, previous work, and the memory. Which key does this on your calculator? _____

6. Which key on your calculator clears the last number entered only? _____

7. If you make a mistake entering the last of several numbers into the calculator, which key would be the most efficient one to press? _____

8. A reasonable rule for handling long calculator answers such as 2.4285714 is to round the answer to _____ of the decimal point.

9. The four basic operation keys are _____, _____, _____, and _____.

10. Name the two operations in which the order of entering whole numbers <u>does not</u> matter. _____ and _____.

11. Name the two operations in which the order of entering whole numbers <u>does</u> matter. _____ and _____.

12. If you want to carry out the operation 53 – 19, you <u>must</u> enter _____ first and then enter _____ after the subtraction sign.

13. In the following division problems, write the first number to be entered and the second number (the one that is entered after the division sign) under the appropriate heading. Write the answer.

	First Number	Second Number	Answer
a. 56 ÷ 14	_____	_____	_____
b. 3/5	_____	_____	_____
c. 212 divided by 16	_____	_____	_____
d. 24 into 108	_____	_____	_____
e. the quotient of 200 and 25	_____	_____	_____
f. 9/4	_____	_____	_____

Part II

Working with fractions and mixed numbers (pp. 9–20)

14. To find the value of a fraction with your calculator, press the key for the _____, then the ÷ key, then the key for the _____, and then the = key.

15. The meaning or value of a fraction such as 3/5 is _____ divided by _____, which equals _____ (final value).

16. When you enter a fraction in the calculator, the display window does not show a _____. Instead, it shows a_____.

17. All proper fractions have a value _____.

18. Write the values of the following proper fractions:
    a. 3/20 = _____
    b. 7/8 = _____
    c. 5/16 = _____

19. The decimal value of any proper fraction will always have a _____ number to the left of the decimal point.

20. The value of an improper fraction is always _____.

21. Read through the four examples of operations with fractions on pages 13 and 14. Three of the four (+, −, ×, ÷) types of problems can be entered correctly without the use of parentheses. Which operation with fractions requires the use of parentheses?_____

22. When _____a fraction by a fraction, always enclose the second fraction by _____and _____.

23. A mixed number is both a _____ and a _____.

24. A mixed number such as 5 3/8 means 5 _____ 3/8.

25. Do examples a, b, and c on page 15. By working these three examples you should realize that to enter a mixed number and find the value you _____ (do/do not) need to use parentheses.

26. On page 16, there are two keys listed that you will need to remember.

    a. When adding mixed numbers, you _____ (will/will not) need to use parentheses to enter the numbers correctly.

    b. When subtracting, multiplying, or dividing mixed numbers, you _____ (will/will not) need to use parentheses to enter the numbers correctly.

27. Read example 5 on page 16 and then on the following two pages read the four different methods that can be used to solve the problem. (This is an addition problem.)

    a. In method 1 she used her calculator to add the _____ and she used mental arithmetic to estimate the sum of the _____. Her total estimate was _____.

    b. In method 2 she used a combination of mental arithmetic and the calculator to get an exact answer of _____. (Why is she using mental arithmetic when she could use the calculator? _____)

    c. In method 3 she separated the mixed numbers by first adding all of the _____ and then adding the _____. The total of the two sums (answers) is _____.

    d. In method 4 she used the calculator and found the total by entering each mixed number. Name the keys in the correct order used to enter 8 3/4. _____. Enter 8 3/4 into your calculator and write the value that is the display window.

28. Do the study activity on page 18 using your method of choice. The answer to the study activity is _____.

UNIT B: Naming Numbers in Different Ways

VIDEO

Problem: Mr. McNeil has hired a builder to add a loft to his house. While the loft is being added, Mr. McNeil asks the builder if he can also add an addition on to the first floor of his house. The builder cautions Mr. McNeil that he may break a local ordinance if he also builds the extension. You must find out whether Mr. McNeil will break either or both of the ordinances.

Given: Foundation dimensions are _____ feet by _____ feet.

Lot dimensions are _____ feet by _____ feet.

Loft area is 85% of the first floor (foundation) area.

Solution

Ordinance 1: This rule states that the foundation cannot cover more than 30% of the lot area. Therefore, we must calculate the original foundation area of the house and add the extension area in order to compare the total area with 30% of the lot area.

Foundation area: _____ (length) × _____ (width) = _____ (area)

Total house area: _____ (foundation area) + _____ (extension area) = _____ (total)

Total lot area: _____ (length) + _____ (width) = _____ (area)

30% × _____ (total lot area) = _____ (allowed by ordinance)

Is the total house area after the extension is added less than the amount allowed by the ordinance?

Is Mr. McNeil able to add the extension without breaking ordinance 1?

Ordinance 2: This rule says that the total square footage of all floors of the house must be less than 60% of the lot area. We must calculate the area of the first floor, second floor and the loft. This total is added to the 300-foot extension and compared to 60% of the lot area to determine if Mr. McNeil is in compliance.

First-floor area: _____ (length) + _____ (width) = _____ (first-floor area)

Second-floor area is equal to the first-floor area.

Loft area: _____ (length) + _____ (width) = _____ (loft area)

Total area of house: _____ (floor 1) + _____ (floor 2) + _____ (loft) = _____ (total)

Total of house square footage plus the 300 square feet for the extension is _____

60% × _____ (total lot area) = _____ (allowed by ordinance)

Is the total area of the house BEFORE the extension less than the square footage allowed by the ordinance?

Is the total area of the house AFTER the extension less than the square footage allowed by the ordinance?

Can Mr. McNeil build the extension without breaking ordinance 2?

Questions

1. What are some examples of fractions showing up in normal, everyday life?
2. What are some situations where decimals are commonly encountered?
3. Do percents have any effect on your life as a student?

STUDY GUIDE

Equipment needed: NO CALCULATORS
graph paper
ruler

Objective: The students will have a better understanding of the meaning of equivalent forms of fractions, decimals, and percents.

Directions

On a sheet of graph paper, draw twelve 10 × 10 grids. (Since a 10 × 10 contains 100 squares, we can easily represent percents and decimals.)

Number the grids 1 through 12.

For each of the twelve problems that follow, use grid 1 for problem 1, grid 2 for problem 2, etc. You will be shading in areas of each grid to represent either a fraction, decimal, or percent. You will then use the shaded area to name the other two equivalent forms of the same given number. Fill in the blanks with the appropriate answers for each problem.

Read through the two examples provided to help you understand how to do this activity.

Example A

Given number	Number of squares shaded	Other two equivalent numbers	
35%	35	0.35	7/20

Since 35% means 35 out of 100, you shade in 35 squares. The shaded area also represents the decimal number 0.35 (thirty-five hundredths.)

The fraction represented by the shaded area is 35 out of 100, or 35/100. The fraction 35/100 would be simplified to 7/20 by dividing the numerator and the denominator by a common factor of 5.

Example B

Given number	Number of squares shaded	Other two equivalent numbers	
2/5	40	0.4	40%

To represent 2/5 you would divide the 100 square grid into 5 equal parts (100 ÷ 5 = 20).

Twenty squares represent 1/5; so 40 squares would represent 2/5.

Find the percent and decimal: 40 squares means 40 out of 100 or 40%, and 40 out of 100 means 40 hundredths (0.40) or simplified, 0.4.

Use the graph paper to shade a representation of these given numbers and then use the shaded area to determine the other two equivalent numbers, as mentioned on the previous page. Refer to the example problems if you need help. Remember, you should have a fraction, a decimal, and a percent for each.

Grid number	Given number	Number of squares shaded	Other two equivalent numbers	
1	25%	_____	_____	_____
2	.3	_____	_____	_____
3	1/5	_____	_____	_____
4	.08	_____	_____	_____
5	3/4	_____	_____	_____
6	80%	_____	_____	_____
7	.35	_____	_____	_____
8	3/100	_____	_____	_____
9	3/20	_____	_____	_____
10	.6	_____	_____	_____
11	5/5	_____	_____	_____
12	12.5%	_____	_____	_____

UNIT C: Finding Answers with Your Calculator

VIDEO

Problem: You have been given the dimensions of the photographs and the text as well as the page size for a newspaper. You have been asked to calculate the space left on the page for advertisements.

Data: 3 photographs each measuring _____ inches by _____ inches
1 photograph measuring _____ inches by _____ inches
1 column of text measuring _____ inches by _____ inches
1 column of text measuring _____ inches by _____ inches
The newspaper page measures _____ inches by _____ inches.

Solution: Calculate the total area of the page and subtract the total area for all the pictures and text columns.

Page area = _____ (length) × _____ (width) = _____ (page area)

Area of three photos: 3 × _____ (length) × _____ (width) = _____

Area of other photo: _____ (length) × _____ (width) = _____

Area of the first column: _____ (length) × _____ (width) = _____

Area of the second column: _____ (length) × _____ (width) = _____

Total area of photographs and text = _____.

Space left for ads: _____ (page area) − _____ (photo/text area) = _____ (ad space)

Questions

1. What are some math problems that you have to solve in the course of a normal day?

2. How do you think teachers and school administrators use math in their daily work?

3. What types of job-related math problems might be solved by an automobile mechanic? a nurse? an electrician? a chef?

STUDY GUIDE

Use the text to help you answer the following questions.

1. List the five steps that help in thinking through a problem.

   a.

   b.

   c.

   d.

   e.

2. Reading the problem allows you to figure out _____ _____ _____.

3. The _____ as well as the _____ provide clues to help you understand the problem and picture it correctly. As you read a mathematics problem, decide what words mean by reading them in the _____ of the problem.

4. Step three requires the _____ and the symbols (+, −, ×, ÷, or =) needed to tell how the numbers relate to each other.

5. A problem that puts together or combines different quantities is generally an _____ _____.

6. List five words or phrases that suggest an addition problem.

   _____ _____ _____ _____ _____

7. A problem that compares two quantities (finds how much more or less) is generally a _____.

8. List five words or phrases that suggest a subtraction problem.

   _____ _____ _____ _____ _____

9. To reduce by a specific amount, you would _____. To reduce by a percent or fraction, _____.

10. A problem that finds a total for many items of the same kind is a _____.
_____ and _____ problems often involve this operation.

11. List five words or phrases that suggest multiplication.

_____ _____ _____ _____ _____

12. A problem that separates something into equal parts or finds the size of each part is most likely a _____ problem.

13. List five words or phrases that suggest division.

_____ _____ _____ _____ _____

REVIEW SHEET

Answer each of the following questions completely. Show all work.

1. List the five steps that help in thinking through a problem.

   a.

   b.

   c.

   d.

   e.

2. List three words that help identify the following mathematical operations:

   a. addition _____, _____, _____.

   b. subtraction _____, _____, _____

   c. multiplication _____, _____, _____

   d. division _____, _____, _____

3. John's grades on five tests were 72, 95, 68, 83, and 85. Find his average grade.

4. If a teacher were to reward 25 students with two cookies, how many cookies would the teacher need to buy?

5. Sue has saved 3/4 of the money needed to buy a jacket costing $139.99. How much has she saved?

6. Teresa works 4 hours on Tuesday, 5 hours on Wednesday, and 3 1/4 hours on Thursday. If Teresa's hourly wage is $5.25, find her gross pay for the three days?

7. Jill bought a shirt for $34.99, two pairs of jeans each costing $45.99, a dress for $69.99, and three pairs of socks for $3.99 each. How much did Jill spend?

8. To find area _____ the length by the width. Area is always expressed in _____ units.

9. John makes $1,083.33 per month. The government withholds 15% of John's check for taxes and $46.17 is deducted for his club dues each month. How much does John take home at the end of the month?

10. If a savings account pays 5 1/8% interest each month, how much interest will $1,500 earn in one month?

11. If three shirts cost $59.97, how much is each one?

12. There were 240 tickets sold to a show. One-fourth of the tickets cost $3.50 and the others were sold for $5.00 each. How much money was received for all 240 tickets?

13. What is the total cost of 19 pens if each one costs $1.09.

14. If Mark has $10.00 and wishes to buy as many cola twelve packs as possible, how many can he buy if each one costs $2.39?

15. Kim pays a monthly car payment of $189.34. Each month the bank takes 15% of the payment for interest. At the end of 36 months, how much interest will Kim have paid?

16. The warehouse of company B has 26 spools of 1/2-inch wire. Each spool has 150 feet of wire. What is the total number of feet of 1/2-inch wire held in the warehouse?

17. Last year, Chris made $13,400. This year she gets paid $360.00 per week. At this rate of pay, does Chris make more or less money than she did last year?

18. The government taxes Chris's pay at a rate of 15% per week. How much of the gross pay of $360.00 per week does Chris take home?

19. The Mitchells are going to carpet their Florida room. The dimensions of the room are 48 feet by 20 1/4 feet. They intend to leave a 5-foot by 7-foot area near the entrance for the pool. Find the total number of square feet of carpeting the Mitchells will use to carpet the floor.

20. If you traveled 1402.5 miles on a trip and averaged 55 miles per hour, how many hours would be required to complete the trip?

UNIT 1: Learning Problem-solving Techniques

VIDEO

Problem: You are asked to calculate the number of tiles needed to cover the countertop.

Solution

Step 1. Understand the problem.

What is given?

Tile size including grout is _____ inches by _____ inches.
Area to be tiled is _____ inches by _____ inches .
Sink area to be omitted is _____ inches by _____ inches.
Breakage allowance is estimated at _____ percent.

Step 2. Develop a plan.

a. Divide the width of the countertop by the _____. This is the number of tiles needed to fill the width of the counter. Round the answer to the nearest whole number.

b. Divide the length of the countertop by the _____. This is the number of tiles needed to fill the length of the counter. Round the answer to the nearest whole number.

c. Multiply the _____ by _____. This is the number of tiles needed to cover the entire countertop.

d. Divide the sink width by _____. This gives the number of tiles needed for the sink width.

e. Divide the sink length by _____. This gives the number of tiles needed for the sink length.

f. Multiply the "sink width" tiles by the "sink length" tiles. This gives the _____.

g. Subtract the tile number in step f from the tile number found in step c. This gives _____, assuming no breakage.

h. Multiply the number in step g by _____ to allow for breakage.

i. Add the number from step h to the number obtained in step _____. This is the total number of tiles needed to complete the job.

Step 3. Carry out the plan.

Make the calculations listed in Step 2.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____

i. _____

Step 4. Check the results by estimation.

a. The estimated length of the counter is _____. The estimated width of the counter is _____. This gives an estimated area of _____.

b. The dimensions of the sink are approximately _____. This gives an estimated area of _____.

c. The net area to be covered is the counter area minus the sink area. This is approximately _____.

d. The dimensions of each tile are approximately _____. This gives an estimated tile area of _____.

e. The number of tiles needed is the net counter area divided by the tile area. This gives approximately _____ tiles.

f. The approximate number allowed for breakage is _____ percent of the net tiles. This gives us a grand total of about _____ tiles for the complete job.

HANDY HINTS IN PROBLEM SOLVING

UNDERSTAND THE PROBLEM (thinking step)	What do you know? List the facts. Organize the information. What questions must be answered to solve the problem?
DEVELOP A PLAN (thinking step)	Draw a diagram. Make a model. Find a pattern. Solve a simpler problem of the same type. Use a known formula. Guess and check. (There is more than one way to solve a problem.)
CARRY OUT THE PLAN (action step)	Set up formulas or equations needed to solve the problem. Decide which operations to use. Perform the calculations.
CHECK THE RESULTS (thinking step)	Ask yourself the following questions: Is the answer reasonable? Does the answer make sense? Is the answer close to my estimate? Does it answer the question?

Name_____
Date _____ Period _____

PRACTICE USING THE STEPS FOR PROBLEM SOLVING

Word Problem Example (Exercise 8 on page 20): You are harvesting your cherry orchard. You estimate there are 200 lugs of cherries. (A lug is a shallow box used to pack and ship fruit.) Ten pickers can finish in 8 days. The cherries sell for $20.00 per lug. You have agreed to pay each picker $3.35 per hour. They work 8 hours per day. What income will remain from the sale of cherries after paying the wages to the pickers?

UNDERSTAND THE PROBLEM

a. List facts in an organized manner.

Facts about cherries

How many units? _____
Selling price each unit? _____

Facts about workers and wages

How many workers? _____
How many days? _____
How many hours per day? _____
What is the hourly wage? _____

b. What question is being asked in the problem? _____

_____

DEVELOP A PLAN

a. Can you answer this question by performing a one-step calculation? _____

b. What question do you need to answer about the cherries? _____

_____

c. What calculations do you need to make to answer that question? List them. _____

_____

d. What question do you need to answer about the workers? _____

_____

_____

e. What calculations do you need to make in order to answer question d? List them. _____

_____

_____

_____

f. List any further calculations needed from results of calculations in c and e. _____

_____

_____

CARRY OUT THE PLAN

Make the calculations listed in c and e.

_____

_____

The answer to the question being asked in the problem is _____.

CHECK THE RESULTS

a. Is the answer reasonable? _____

b. Does the answer make sense? _____

c. Does it answer the question? _____

UNIT 2: Estimating Answers

VIDEO

Problem: You are asked to calculate the estimated cost of feeding the three Lanthier children for one year.

Given: Food cost per child for one week _____
Number of children _____
Inflation rate _____
Appetite increase percentage _____

Solution: You must first find the amount it will cost to feed one child for one full year. Then calculate the cost for three children for one full year. Using the total annual cost for three children, you can find the dollar amount for inflation and appetite increase. The sum of these items will give the estimated annual dollar amount to be budgeted.

Food per child for 1 year = cost per week × no. of weeks per year

= _____ × _____

= _____

Food per year for 3 children = dollars per year for 1 child × 3

= _____ × 3

= _____

Increase due to inflation = dollars per year for 3 children × rate

= _____ × ____

= _____

Appetite increase dollars = dollars per year for 3 children × rate

= _____ × ____

= _____

Expected food budget = food dollars for 3 + inflation dollars + appetite dollars

= _____ + _____ + _____

= _____

Questions

1. What does estimating mean?
2. Do you ever have to estimate answers in your life?
3. What types of jobs require estimating skills?

STUDY GUIDE

1. List two examples that show a situation where a close answer is all you need.

   a.

   b.

2. List two examples that show a situation where an exact answer is required.

   a.

   b.

3. How "rough" a rough estimate is depends upon _____
   _____.

4. Complete the following chart.

	ten thousands			tens			hundredths		

5. Rounding is one method of approximating an answer. List the four steps for rounding as given on pages 9-10 in the text.

   a.

   b.

   c.

   d.

6. Use the four steps for rounding to round the following set of numbers.

Round to the nearest thousand.	Round to the nearest tenth.
a. 7,644 _____	a. 76.44 _____
b. 406,342 _____	b. 406.342 _____
c. 2,705 _____	c. 27.05 _____
d. 19,852 _____	d. 1.9852 _____
e. 72,475.98 _____	e. 72,475.98 _____

7. Use the following problem to find the answer. First, solve the problem by adding all the numbers and rounding off. Then, solve the problem again. This time round all the numbers to the nearest pound and then add the numbers.

   14.202 lb. + 17.64 lb. + 15.79 lb. + 15.67 lb. = _____ answer 1

   _____ answer 2

   Did you get the same answer? _____
   If you were selling gold by the pound, which method would you prefer to use?

8. Truncating is another way to estimate numbers. In truncating, you replace all numbers but _____ with zeros.

   Truncate the following numbers.

   a. 7,644 _____
   b. 406,342 _____
   c. 2,704 _____
   d. 19.852 _____
   e. 72,475.98 _____

9. Estimate the answer to the following problem using the given approximation technique:

   117.768 + 173.07 + 897.5 + 943.6 = _____

   The actual answer is _____.

   a. Rewrite each number rounding to the nearest hundred, then add.
   b. Rewrite each number rounding to the nearest ten, then add.
   c. Rewrite each number by truncating, then add.

10. How does your actual answer compare to the three estimates? Explain.

UNIT 3: Measuring in English and Metric Units

VIDEO

Problem: You are asked to calculate the profit Winston's will make on material that is purchased by the meter and then sold by the yard.

Given: Meters of material purchased _____

Price per meter _____

Price per yard _____

One meter is approximately equal to _____ yard(s).

Solution: The first item to be considered is the total amount Winston's paid for the material. This is called the wholesale cost. Next, you must convert the number of meters to the number of yards. Once you know how many yards Winston's can sell, you can calculate the retail income from the material. Profit is determined by subtracting the wholesale cost from the retail income.

Wholesale cost of material = number of meters × cost per meter

= _____ × _____

= _____

Number of yards on hand = number of meters × number yard/meter

= _____ × _____

= _____

Retail income from sale = number of yards × price per yard

= _____ × _____

= _____

Profit on retail sale = retail income − wholesale cost

= _____ − _____

= _____

Questions

1. What are units of measure?
2. Could you get along in life without using units of measure?
3. What are the most common units of measure that you deal with on a day-to-day basis?
4. Can you think of any ways that metric measurements affect your life?

TEST YOUR KNOWLEDGE

Answer the following questions by choosing the correct letter.

1. length of an adult cow: (a) 1 m (b) 3 m (c) 5 m
2. distance across this page: (a) 1.93 mm (b) 19.3 mm (c) 193 mm
3. distance from Miami to Seattle: (a) 500 km (b) 5,000 km (c) 50,000 km
4. weight of an automobile: (a) 1,300 kg (b) 130 kg (c) 13 kg
5. height of a person: (a) 180 cm (b) 1800 cm (c) 18 cm
6. length of a train: (a) 8 m (b) 80 m (c) 800 m
7. length of a pair of Levis: (a) 70 cm (b) 700 cm (c) 7 cm
8. diagonal measure of a TV set: (a) 5 cm (b) 50 cm (c) 500 cm
9. thickness of a compact disc: (a) 0.9 mm (b) 9 mm (c) 90 mm
10. length of a luxury car: (a) 1 m (b) 3 m (c) 5 m
11. length of a nose: (a) 3 cm (b) 30 cm (c) 0.30 cm
12. weight of an algebra textbook: (a) 1 kg (b) 10 kg (c) 0.1 kg
13. volume of a 12-oz. can of soda: (a) 40 ml (b) 400 m (c) 4000 ml
14. diameter of the earth: (a) 130 km (b) 1,300 km (c) 13,000 km
15. volume of a basketball: (a) 1 l (b) 4 l (c) 7 l
16. weight of a person: (a) 700 kg (b) 7 kg (c) 70 kg
17. length of a record album cover: (a) 300 mm (b) 30 mm (c) 3,000 mm
18. length of a hot dog: (a) 120 cm (b) 12 cm (c) 1.2 cm

Decide whether the following doses of medicine are reasonable. Write yes or no.

19. Take 2 kg of aspirin three times a day.
20. Take 4 l of antihistamine every evening at bedtime.
21. Take 25 ml of cough syrup daily.
22. Soak your feet in 6 l of hot water every day with 550 mg of Epsom salt.
23. Inject 1/2 l of insulin every morning.
24. Take 1 gram of penicillin three times daily.
25. Take 10 hectograms of apples per day to keep the doctor away.

40

REVIEW SHEET

1. What is the basic unit for capacity in the metric system? _____ for weight? _____ for length? _____
2. Which is heavier—15 kg or 15 lbs.? _____
3. How tall are you in meters? _____
4. Which is longer—10 mi or 10 km? _____
5. If you measure 65" tall, would you measure more or less than 65 cm? _____
6. What is room temperature in Celsius? _____
7. What is a hot day in Celsius? _____
8. Write your weight in kg. _____
9. Write your height in inches and centimeters. _____ _____

Equivalences

10. 1 cup = _____ tbsps.
11. 1 tbsp. = _____ tsp.
12. 1 mile = _____ ft.
13. 1 qt. = _____ pts.
14. 1 pt. = _____ cups
15. 1 gal. = _____ qts.
16. 1 ton = _____ lbs.
17. 1 cup = _____ oz.
18. 1 yd. = _____ ft.

Understanding Measurement

19. If you were measuring an ant, would you use mm, cm, or km? _____
20. An eyedropper would measure liquids in liters, cubic feet, or milliliters? _____
21. If it were 10° C outside, would you wear your bathing suit, slacks and a sweater, or some type of jacket?
22. Draw line segments measuring the following lengths:
    a. 4 7/8"
    b. 2 3/4"
    c. 5.5 cm

Conversions

23. 20 gal. = _____ liters (1 gal. = 3.785 liters)
24. 40 liters = _____ gal.
25. 5 kg = _____ lbs. (1 lb. = .453 kg)
26. 75 miles = _____ km (1 mile = 1.609 km)
27. 100 g = _____ oz. (1 g = .035 oz.)
28. 100 m = _____ yds. (1 yd. = .914 m)
29. 5 tbsp. = _____ tsp.

UNIT 4: Using Graphs, Charts, and Tables

VIDEO

Problem: You will make several graphs showing the number of viewers of a daily music show by age group. The first graph will be a bar graph showing the numbers of persons in each age group. The second bar graph will show percentages of the total viewership by age group. Then, draw a circle graph showing the percentages of each age group.

Given: Number of viewers — Age group

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Solution: You may use the Acculine drawing kit or graph paper.

Graph 1: Choose a title. Determine the range of the numbers and the labels needed for the bottom and right side of your graph. Decide what units you are using for your graph. Draw the picture of the information given.

Graph 2: Choose a title. Determine the percentages of the total viewership that each age group represents. (To do this, first find the total viewership.) Find the range of numbers needed and the labels for the bottom and right side of your graph. Identify the units necessary. Draw the picture of the information.

Graph 3: Choose a title. Determine the number of degrees needed for each slice of the pie. (To do this, multiply the percent by 360 degrees.) Identify the labels you will use. Draw the circle and complete the graph.

Questions

1. What is the advantage of using pictures rather than words to convey information?

2. How are charts and graphs similar to pictures?

3. Can you think of any tables that you use in your daily life?

4. Why would someone wish to present information in the form of tables?

STUDY GUIDE

Use the text to answer the following questions.

1. Most of us grasp information better and quicker when it is presented to us in _____ form. _____, _____, and _____ present numbers and other kinds of information in this form.

2. One of the simplest ways to organize numbers is to put them all in _____.

3. Tables show groups of data that _____.

4. Using the table labeled "Grade Report" on page 4, complete the following:

   a. What is the title of this table?

   b. What are the labels for each row?

   c. What are the labels for each column?

   d. What do the three letters in the first row have in common with each other?

   e. What do the letters in the first column have in common with each other?

Reading Bar Graphs

5. A bar graph is _____.

6. What does a bar graph do that a list of data, a paragraph, or a table does not?

7. Study the bar graph in Figure 4-3 on page 6, then answer the following:

   a. Should automobiles be included on the graph? Why or why not?

   b. How many appliances are shown?

   c. What appliances are used in over half of the households?

   d. What appliances are used in less than half of the households?

   e. What other information do you need to find out how many households have home computers?

8. What is the difference between vertical and horizontal bar graphs?

9. Study the graph on page 8, then answer the following:

   a. What is the significance of the "crooked" line on the vertical axis?

   b. Which month shows the highest amount of personal spending?

   c. How much money was spent during January? February?

10. List the four steps given in the text to read <u>any</u> graph:

    a.

    b.

    c.

    d.

11. When drawing a bar graph, you must first determine what units are being used before you can identify the _____ between the largest and smallest numbers.

12. Bar graphs are good for showing _____
    _____.

13. Vertical bar graphs work best for _____
    _____.

Circle Graphs

14. Circle graphs usually show how _____
    is made up of several _____.

15. Each part of the circle is shown as _____.
    The entire circle represents _____. Together the percentages add up to _____.

16. Circle graphs do not show _____ as a bar or line graph might show.

Line Graphs

17. When a line graph is extended to gather additional information not shown, we call this _____.

18. When we wish to gather information from a line graph that is between two dots on the line, we call this _____.

19. Line graphs, whether straight or curved, show _____.

Read the Summary on pages 27-28 to help you answer the following questions.

20. You need to make several decisions to construct graphs. You must decide on the _____, the _____ that fits the space you have, and how to _____.

21. If you are displaying current conditions or are comparing parts to the whole, you may want to use a _____.

22. If you have a few quantities to be compared or want to show a trend, you may chose a _____ graph.

23. If you have a large amount of related data or want to show trends or provide the opportunity to extend data, you may want to use a _____ graph.

UNIT 5: Dealing with Data

VIDEO

Problem: You have been asked to help Steve Anthony, the disc jockey, schedule events into a fluid 30-minute program. The time slot is from 4:00 p.m. to 4:30 p.m. At the radio station, time slots are written showing hours, minutes, and seconds. Some of the commercials, songs, and artist information slots are not recorded in full minutes. In order to have a clear idea of what one full minute of artist information is, have a partner time you as you speak for one full minute about a topic of interest of you. After you have completed your one full minute, you will be more understanding as you complete the 30-minute program schedule.

Given: 5 songs with lengths of _____, _____, _____, _____, and _____

1 news broadcast with a length of _____

1 sports broadcast with a length of _____

1 weather forecast with a length of _____

8 commercials: 2 with a length of _____ and 6 with a length of _____

Q-107 jingle required near 4:15 p.m. and takes _____ seconds

A category called artist information accounts for all slack time.

Solution: Complete the chart on the next page. Be sure to account for all of the 30 minutes given. (Hint: Find exactly how much time will be needed for artist information before you begin to schedule the required songs, commercials, etc.)

Notice how time is listed for a required song to be played at 3:30 followed by a commercial:

Time	Event	Length
3:30:00 - 3:32:45	song	2 minutes 45 seconds
3:32:45 - 3:33:15	commercial	30 seconds
	Total Time:	3 minutes 15 seconds

TIME	EVENT	LENGTH
4:00		

TOTAL TIME: _____

STUDY GUIDE

Use the text to answer the following questions.

1. What are data?

2. List three ways data are given.
   a.
   b.
   c.

3. What do people do with the data they collect?

4. List five examples of where data might be found.
   a.
   b.
   c.
   d.
   e.

5. When solving a problem that needs data, go through the following steps to collect the data:
   a.
   b.
   c.

6. List three points to think about when collecting data.
   a.
   b.
   c.

7. What problem are Sue and Jerry trying to solve?

8. How are they going to get the data they need?

9. What does the accuracy of the data collected have to do with solving the problem?

10. Of what importance is time when collecting data?

11. Explain what is meant by trouble and expense in collecting data.

12. Which way did Sue and Jerry choose to get their data?

13. Do you think this is the best method? the quickest? the easiest?

14. What effect do time, accuracy, and trouble have on the data collected?

15. Will a 100-telephone-call sample sufficiently represent the American population? For example, if you sampled 100 people by telephone in Ohio about the possibility of finding a cure for cancer, would you be able to generalize that this is how the entire American population feels? Explain your answer.

16. What statement could be made about the survey conducted in question 15?

17. List four ways to organize data.

    a.

    b.

    c.

    d.

18. When would you use a tally to organize data?

19. Why might a graph be useful in organizing data?

20. When would you use a picture?

21. Give an example of when you might use a table?

22. How did Sue and Jerry organize their information?

23. What is "making sense" out of organizing data called?

24. List three ways to interpret data.

    a.

    b.

    c.

25. Look at the table Sue and Jerry constructed on page 13. Which store do you think has the lowest prices based on the number of circles for each store?

26. Calculate the totals for each store for all eight items and list these data below.

27. Is the store with the lowest grand total the same store with the most circled items?

28. What additional information do Sue and Jerry need before they can predict which store will be the lowest priced next month?

29. How did Tim collect his data?

30. How did he organize his data?

31. How did he interpret his data?

32. How did Maria collect her data?

33. How did she organize her data?

34. How did she interpret her data?

35. Suppose that Maria wants to fill the garden box with dirt. Calculate how many cubic yards of dirt she will need.

36. Who might use data?

37. The four steps for dealing with a problem that needs data are:

    a.

    b.

    c.

    d.

UNIT 6: Working with Lines and Angles

VIDEO

Problem: The ordinance in question regulates the height of buildings. There are a number of ordinances in each town or city to determine how high, wide, or long a building can be. Architects, surveyors, and draftspersons need to be concerned with these ordinances on a daily basis. In this case, you need to determine if the tower is in compliance with the new ordinance limiting structure height to 50 feet.

Given: The tower is _____ feet away.

Maximum allowable height is _____ feet.

Height of the measuring instrument is _____ feet.

The vertical angle is _____ degrees.

Solution: One method to determine compliance in this case is to use a scale model of the tower. Using your Acculine drawing kit, draw a picture of the distances with your teacher's assistance. The scale to be used is 1 inch = 25 feet. Attach your drawing to this paper.

Questions

1. Where do you see lines and angles in the real world?

2. What difference would it have made if the people who built the room you are in had not paid careful attention to measuring lines and angles?

3. What is an angle that you commonly see every day, almost everywhere you are?

STUDY GUIDE

Define each of the following terms:

1. point
2. line
3. line segment
4. ray
5. angle
6. vertex
7. circle
8. radius
9. diameter
10. circumference

Use the following points to complete questions 11-19.

. A

. B . E

. C

. D

11. Draw line CE.
12. Draw line AB.
13. Do line CE and line AB cross each other?
14. Draw line segment CD.
15. Do line AB and line segment CD cross each other?

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16. What point is found on both line CE and line segment CD?

17. Draw line segment AE.

18. Name the vertex of angle BAE.

19. Name the sides of angle DCE.

20. What is the length in inches of the line segment that extends along the edge of this paper from the top to the bottom?

21. What is the length of this same line segment in centimeters?

22. What is the length of the line segment that joins the upper right corner with the lower left corner of this page in inches? in centimeters?

23. What is this line called?

24. How many diagonals are there on this paper?

25. What can you say about the length of the diagonals of this paper?

UNIT 7: Working with Shapes in Two Dimensions

VIDEO

Problem: Carpet layers confront many problems dealing with the mathematics of two dimensions when they replace carpeting with new carpet. They need to calculate the number of square feet in the room and convert this to a number of square yards. You are asked to determine the number of square feet in the room and the number of square yards of carpet that are needed for the room.

Given: Dimensions of the area to be carpeted _____

Size of the carpet roll _____

Carpet price per square yard _____

Solution

1. Calculate the area of the room. Give your answer in square feet.

2. Calculate how many square feet are in one square yard.

3. Convert the number of square feet in the room to square yards to determine how much carpet to buy and how much it will cost.

   _____ square feet = _____ square yards

   Cost for _____ square yards at _____ per square yard is _____.

Questions

1. What two-dimensional shapes (figures) do you see most often?

2. What two-dimensional shapes (figures) do you see in the room around you?

3. When this room was built, what were some of the problems related to two dimensions that had to be solved?

STUDY GUIDE

Use the text to complete the following questions.

1. Define the following as given on page 5.

   a. triangle

   b. right triangle

   c. rectangle

   d. square

   e. parallelogram

   f. trapezoid

   g. circle

2. Diagonals are drawn _____.

3. Two diagonals of a rectangle are _____.

4. Define perimeter.

5. To find the perimeter of a figure, _____.

6. Perimeter is a _____ measure.

7. The most common way to calculate the perimeter of a rectangle is to say that it is _____.

8. Name three instances in everyday life when finding the perimeter is necessary:

   a.

   b.

   c.

9. A carpenter that lays the forms for a foundation checks to see that:

   a.

   b.

10. Suppose you checked and found that the opposite sides of the wooden frame for the foundation were equal and parallel, but you didn't check the corner angles. Would the shape necessarily be a rectangle? _____ What shape might it be? _____

11. Carefully read steps 1–6 given on pages 9 and 10. What measurement would you make to be convinced that the shape you laid out is indeed a rectangle?

12. Area is _____.
    It is measured in _____.

13. Given a figure laid out on a grid, how could you estimate the area?

14. To calculate the area of a rectangle, _____.
    This is commonly known as _____.

15. Figure 7-4 on page 15 shows two triangles. How does the area of each triangle inside compare to the area of the rectangle drawn around it?

16. To calculate the area of a triangle, _____.
    This is commonly known as _____.

17. A formula is _____.
    It tells you _____.

18. The distance around a circle is called the _____.

19. The distance around a circle divided by the distance across the circle at its widest point is always equal to _____.

20. Pi is equal to _____ or the fraction _____.

21. The circumference is calculated by _____.
    This is commonly known as _____.

22. To calculate the area of a circle, multiply _____.
    This is commonly known as _____.

23. Two triangles are similar if _____.

24. If two triangles are similar, then _____.

25. Define hypotenuse.

UNIT 8: Working with Shapes in Three Dimensions

VIDEO

Problem: Many shipping companies attempt to pack boxes with as little wasted space as possible. In this video, you are asked to calculate how many football and soccer boxes can be packed inside a shipping box.

Given: Dimensions of the shipping box are _____ length, _____ width, and _____ height.

Dimensions of the football box are _____ length, _____ width, and _____ height.

Dimensions of the soccer box are _____ length, _____ width, and _____ height.

Solution

Find the volume of the shipping box and the smaller boxes to be packed inside. Then, calculate how many times the volume of the smaller boxes goes into the shipping box.

Shipping box volume = length × width × height

= _____ × _____ × _____

= _____

Football box volume = length x width x height

= _____ × _____ × _____

= _____

Soccer box volume = length × width × height

= _____ × _____ × _____

= _____

Maximum football boxes
in one shipping box = shipping box volume ÷ football box volume

= _____ ÷ _____

= _____

Maximum soccer boxes
in one shipping box = shipping box volume ÷ soccer box volume

= _____ ÷ _____

= _____

Is this an accurate count of how many boxes of balls can be packed inside the large shipping box? Why or why not?

Questions

1. What are some three-dimensional shapes?

2. How are three-dimensional shapes different from two-dimensional shapes?

3. How are three-dimensional shapes similar to two-dimensional shapes?

4. What are the three dimensions?

STUDY GUIDE

Use the text to answer the following questions.

1. Geometric figures on flat surfaces, such as _____, have _____ dimensions.

2. These two-dimensional figures are usually _____ and _____.

3. Figures that are solid or _____ have a _____ dimension, which is usually called _____ or _____.

4. Three-dimensional shapes occupy a certain amount of _____ and have a certain amount of _____. The amount of space it occupies is called the _____ or _____.

5. The area of all surfaces of a three-dimensional figure is called the _____.

6. You might need to know the total surface area of a container in order to _____.

7. List the four geometric solids to be studied in this unit.

   a. _____

   b. _____

   c. _____

   d. _____

8. An example of a cylinder is a _____.

9. Name the two shapes that make up the parts of a cylinder.

   a. _____

   b. _____

10. The _____ forms the sides of the cylinder and the _____ form the bases.

11. What information is needed in order to find the volume of a cylinder?

12. What information is needed in order to find the total surface area of a cylinder?

13. What is the difference between the total surface area of a cylinder and the lateral surface area of the cylinder?

14. The units used to show a volume measure are _____.

15. What units are used to show total surface area or lateral area?

16. How many surfaces does a rectangular solid have? _____

17. The total surface area of a rectangular solid is calculated by _____
_____.

18. If the base of a rectangular solid has a length (L) and a width (W), what would the area of the base be? _____

19. The special rectangular solid that has an equal length, width, and height is called a _____.

20. Funnels represent what type of geometrical shape?

21. What information is needed in order to find the volume of a cone?

22. What information is needed in order to find the total surface area of a cone?

24. What is the difference between the height of a cone and the slant height of a cone?

25. For a sphere, the lateral area and the surface area are the same because there is only _____ surface on a sphere.

26. The one piece of information needed to find both the surface area and the volume of a sphere is the _____.

HINTS FOR WORKING PROBLEMS THAT INVOLVE THREE-DIMENSIONAL FIGURES

- Ask yourself: With which figure or shape am I working? Do I need to use the formulas for a cylinder, a rectangular solid, a cone, or a sphere?
- Draw a rough sketch of the figure and label its dimensions.
- Ask yourself: For which quantity am I looking? Am I solving for lateral area, total surface area, or volume?
- Ask yourself: Is any part of this figure missing? Are both the top and the bottom included? Is the tank an open one? Is this a hemisphere? Is the base of the cone included?
- Check that all dimensions are expressed in the same units. Don't try to multiply feet by yards, or meters by inches.
- Check the units on the final answer: Surface area will be in square units; volume will be in cubic units.

The surface areas and volumes of four basic geometric figures are given by the following formulas: (r is radius; h is height; w is width; l is length; C is circumference; e is length of edge of a cube; d is diameter; s is slant height of a cone.

Cylinder

Lateral area = $2\pi rh$
Area of each base = πr^2
Total surface area = $2\pi rh + 2\pi r^2$
Volume = $\pi r^2 h$

Rectangular Solid

Total surface area = $2wh + 2lh + 2lw$
Volume = length × width × height

Cube

Total surface area = $6e^2$
Volume = e^3

Cone

Area of the base = πr^2
Lateral area = $1/2sC$ or $1/2s \times 2\pi r$
Total surface area = $1/2sC + \pi r^2$
Volume = $1/3\pi r^2 h$

Sphere

Area = πd^2 or $4\pi r^2$
Volume = $4/3\pi r^3$

UNIT 9: Using Ratios and Proportions

VIDEO

Problem: The need for additional insecticide requires that you calculate the amount of water that should be mixed with 75 gallons of concentrate if the ratio is to be 3 parts of insecticide to 5 parts of water.

Given: _____ gallons of insecticide concentrate

_____ parts of insecticide to _____ parts water

Solution: Calculate the amount of water to be used with the concentrate and identify the total amount of ready-to-use insecticide on hand.

Set up a proportion and solve for the unknown.

$$\frac{\text{parts insecticide concentrate}}{\text{parts water}} = \frac{\text{75 gallons insecticide concentrate}}{\text{X gallons of water}}$$

$$\frac{\qquad}{\qquad} = \frac{\qquad}{\qquad}$$

$$X = \qquad$$

Compute the total amount of ready-to-use insecticide by adding the amount of concentrate used to the amount of water used.

75 gal. insecticide concentrate + _____ gal. water = _____ gal. mix

Questions

1. Name four occupations from the video where ratios and proportions are used on the job.

2. What are some typical applications of ratios and proportions? How are they used in the real world of work/life?

STUDY GUIDE

1. What are four ways to write a ratio for 7 to 5.

   _____ _____

   _____ _____

2. Read through the example on page 9 (the paragraph that begins "In an experiment . . .) and then write a simplified ratio using the same units for a ratio of 15 minutes to 1 hour. Write two simplified ratios—one using all minutes and one using all hours.

   _____ _____

3. How can you determine if two given ratios are equal? (There are three ways)? Show your work when determining if the following ratios are equal.

   a. $\frac{21}{63}$ $\frac{8}{24}$ b. $\frac{1.5}{2.1}$ $\frac{.5}{.8}$ c. $\frac{.9}{3.8}$ $\frac{2.7}{11.4}$

4. What are the cross terms of the ratios $\frac{25}{10}$ and $\frac{35}{14}$?

5. What are the products of the cross terms in problem 4?

6. What are similar figures?

7. If two figures are similar, the ratios of the corresponding (or matching) sides are the _____.

For questions 8-9, use Figure 9-6 on page 12.

8. Name the sides of triangle C that correspond to the given sides of triangle A.

   s corresponds to ___
   r corresponds to ___
   q corresponds to ___

9. Use your answers in 8 to write three ratios that would be equal.

   _____ = _____ = _____

10. Answer the question in the study activity at the top of page 13.

11. How can you determine if two figures are similar?

12. How can you identify a proportion?

13. On page 15 there are four examples of written proportions. Three of these are true proportions because the comparisons are alike. One of them is not a proportion because the comparisons (ratios) are not alike. Which of these four is <u>not</u> a proportion?

14. If the scale on a set of drawings was 1 cm = 1 ft., write a proportion that could be used to find the actual length of the living room if the length on the drawing was 22.5 cm.

UNIT 10: Working with Scale Drawings

VIDEO

Problem: Calculate the area of a field shown in an aerial photograph. The scale of the photograph is given so the area can be calculated in both square feet and acres. You are then asked to find the area covered by the entire photograph in square feet.

Given: Scale of photograph = _____

Field in photograph measures = _____

Photograph measures = _____

1 acre = 43,560 square feet

1 square mile = _____ square feet

Solution:

1. The area of the field in square feet is:

   (field length × scale) × (field width × scale) = area of field

   (_____ × ____) × (_____ × ____) = area of field

   (_____) × (_____) = area of field

   _____ = area of field

2. The area of the field in acres is:

   area of field in acres = area in square feet ÷ square feet per acre

   = _____ ÷ _____

   = _____

3. The area covered by the entire photograph in square miles:

   (photo length × scale) × (photo width × scale) = area in sq. ft.

   (_____) × (_____) = area in sq. ft.

   (_____) × (_____) = area in sq. ft.

   _____ = area in sq. ft.

Divide the area in square feet by the number of square feet in one square mile.

Area in square miles = area in sq. ft. ÷ square feet per mile

= _____ ÷ _____

= _____

Questions

1. What kinds of scaled drawings have you worked with in the past?

2. Have you ever used a map to assist you in finding a given location or to determine the best route of travel?

3. What types of scaled drawings have you made in school?

4 List three occupations that work with scaled drawings.

   a.

   b.

   c.

STUDY GUIDE

Use the text to complete the following questions.

1. Define:

   a. working drawing

   b. assembly drawing

   c. blueprint

   d. congruent

   e. 1:1 ratio

2. The corresponding measurements of two congruent figures are _____.

3. Scaled-down models are _____
   _____.

4. Similar figures or models have exactly _____
   _____.

5. When two figures are similar, _____
   _____.

6. The scale of the drawing refers to _____
   _____.

7. Is a drawing with a scale of 1:10 an example of a scaled-up or a scaled-down model?

8. Is a drawing with a scale of 4:3 an example of a scaled-up or a scaled-down model?

9. Blueprints and scale drawings often have writing called a _____ in the corner that tells you _____.

10. A graphic scale is a _____
    _____.

11. Before you write the scale as a fraction or ratio without units, _____
_____.

12. List three reasons why a scale is important.

    a.

    b.

    c.

13. When you use scaled-down drawings, a small error in measurement is _____. For example, an error of 1/8 inch in measuring the drawing becomes an error of _____ in the actual building if the scale was 1:60.

14. The larger the scale, the _____ the error possibility.

15. Most maps are _____ of parts of the earth's surface.

16. Define:

    a. relief map

    b. contour map

    c. topographical map

    d. nautical charts

    e. aeronautical charts

17. Draw and label a compass rose.

18. Use the map on page 22 to answer the following.

    a. What direction would you travel to get from Chicago to Los Angeles?

    b. What direction would you travel to get from Seattle to Los Angeles?

    c. What direction would you travel to get from New Orleans to Chicago?

19. After reading example four on page 23, find the direction from Chicago to Seattle using the protractor.

20. List the four ways to represent a scale where 1 cm on a drawing is actually 12 meters.

    a.

    b.

    c.

    d.

21. What two measurements do you need to know in order to decide on an appropriate scale?

21. Give two examples of the use of a scaled-up model.

22. Give two examples of the use of a scaled-down model.

23. What is the ratio of an actual-size model and the real object?

UNIT 11: Using Signed Numbers and Vectors

VIDEO

Problem: You are asked in the video to use signed numbers to find the closing balance for a given checking account.

Given: Balance _____

Interest _____

Charges _____

Deposits _____

Checks _____

Solution: You should begin by considering each of the activities listed for the account. Determine if each figure is to be added to the balance or subtracted from it. Enter a signed number on each line next to the activity. Compute the closing balance by entering the signed numbers into your calculator.

Balance $600.00

Interest _____

Charges _____

Deposits _____

Checks _____

Closing Balance _____

Suppose the total of the checks written is $1,300 instead of $525. Compute the new closing balance.

Balance $600.00

Interest _____

Charges _____

Deposits _____

Checks _____

Closing Balance _____

Questions

1. What effect does this new closing balance have on the bank customer?
2. How will the bank react to seeing this new balance?
3. What words indicate positive numbers? negative numbers?
4. Who might use vectors on the job?
5. Who might use signed numbers on the job?

STUDY GUIDE

Use the text to complete the following questions.

1. Another term for the size of a number is _____.
2. Positive and negative numbers are called _____.
3. Line segments that have an arrow on one end can be used to show positive or negative quantities. These directed line segments are called _____.
4. Each vector has two properties: _____ and _____.
5. The zero point on a number line is called the _____.
6. All numbers to the right of zero are _____ and all numbers to the left are _____.
7. What number on the number line is neither positive nor negative?
8. Is it necessary to write a positive sign or a negative sign on all numbers?
9. The distance of a number from zero (ignoring direction) is called the _____ of the number.
10. Write "the absolute value of negative ten" in mathematical form using the absolute value symbols.
11. Which has a larger absolute value: -4 or -8? Explain.
12. Is the following equation true?

    $1 - 41 = 1 + 41$

13. When two numbers are the same distance from zero on a number line (ignoring direction), then the numbers have _____ _____.
14. Write the rule to follow when adding two negative numbers.
15. Write the rule to follow when adding one positive and one negative number.

16. Write the rule to follow when subtracting one positive number and one negative number.

17. When multiplying or dividing two positive numbers, the sign of the answer is always _____.

18. When multiplying or dividing two negative numbers, the sign of the answer is always _____.

19. When multiplying or dividing one positive and one negative number, the answer is always _____.

20. The length of a vector is another name for the _____ or _____.

21. A vector always has both _____ and _____.

22. The arrow tells you the _____ while the length of the line segment tells you the _____ of the vector.

23. In order to know the size of a vector, you must have a _____.

24. The beginning point of a vector is called the _____ and the ending point (the arrow) is called the _____.

25. What is the meaning of the resultant vector?

UNIT 12: Using Scientific Notation

VIDEO

Problem: You are asked to estimate the volume of water in a lake. Given the volume of water in the lake and the number of trout per one million cubic feet of water, estimate the total number of fish in the lake. This estimate can be important for conservation efforts and fishing reports.

Given: $V = \pi \times r \times r \times d$

V = _____

r = _____

d = _____

Solution

1. Notice that the formula given is the same as that for the volume of a cylinder. Find the volume using the formula.

   $V = \pi \times r \times r \times d$

   $V = \pi \times$ _____ $\times$ _____ $\times$ _____

   V = _____

2. The number of trout in the entire lake can be found by dividing the volume of the lake by the number of gallons needed for one fish.

   number of trout = volume of lake ÷ number of gallons for one fish

   = _____ ÷ _____

   = _____

Questions

1. What are some examples of very large numbers?
2. Who might use very large numbers on the job?
3. What are some examples of very small numbers?
4. Who might use very small numbers on the job?

STUDY GUIDE

Use the text to help you complete the following questions.

1. Name three occupations in which people might use scientific notation on the job.

   a.

   b.

   c.

2. Define scientific notation.

3. The first part of an expression written in scientific notation is just _____. The second part is _____. Identify the first part and the second part of the example below.

   7.39×10^{25}

4. 10^4 and 10^9 are called _____.

5. The power of ten is nothing more than the number 10, called the _____, raised to _____. The power, or _____, is the number _____.

6. Complete the following:

100^2	=	10	base	_____	exponent	_____
1,000	=	_____	base	_____	exponent	_____
10,000	=	_____	base	_____	exponent	_____
100,000	=	_____	base	_____	exponent	_____
0.01	=	_____	base	_____	exponent	_____
0.001	=	_____	base	_____	exponent	_____

7. A negative exponent tells you _____ _____ and multiply to get the number.

8. 10^0 or "ten to the zero power" is another name for _____.

9. Complete the chart.
   10^{+value} indicates numbers greater than one.

   10^{0} indicates _____.

   10^{-value} indicates _____.

10. Multiplying by ten is the same as _____.

11. Multiplying by 1/10 is the same as _____.

12. Rewrite in correct scientific notation:

    679.5×10^{20} = _____

13. To convert from decimal form to scientific notation (without the calculator):

    a.

    b.

    c.

    d.

14. To convert from scientific notation to decimal form (without the calculator):

    a.

    b.

    c.

15. Write the keying sequence used to enter 5.46×10^{4} into the calculator.

16. What is the keying sequence needed to have the calculator display the number in question 15 in decimal form?

17. Write the keying sequence used to enter 35,000,000 into the calculator so that it is shown as a number in scientific notation.

18. If the exponent is larger than _____, most calculators cannot display the number.

19. To multiply two powers of ten, you would _____

_____.

20. To divide two powers of ten, you would _____

_____.

21. What does the chart on page 29 assist you in doing?

UNIT 13: Precision, Accuracy, and Tolerance

VIDEO

Problem: You have been asked to calculate the precision of the lathe that will turn out a rod of a given diameter. You must find out if the rod is within the specified tolerance range.

Given: Lathe division = _____

Rod measurement = _____

Rod diameter = _____

Tolerance = _____

Solution

1. The measurement of the rod is _____ and the specification is _____ (rod diameter ± the tolerance). The difference between the rod measurement and the specification is the rod measurement minus the rod diameter.

   Difference = rod measurement − rod diameter

   = _____ − _____

   = _____

   The rod is/is not within the tolerance allowed.

2. Find the upper and lower limits allowed by the specifications, given the tolerance range.

   Upper limit = rod diameter + rod tolerance

   = _____ + _____

   = _____

   Lower limit = rod diameter − rod tolerance

   = _____ + _____

   = _____

Questions

1. Define accuracy.

2. Define precision.

3. Do you think that a lathe could really turn out a rod with a diameter of .026 mm? Why or why not?

REVIEW SHEET

Complete the following statements.

1. The precision of the vernier caliper is _____. The error of measurement is _____.
2. The precision of the micrometer is _____. The error of measurement is _____.
3. The precision of the machinist's rule is _____. The error of measurement is _____.

Complete the chart.

	Upper limit	Lower limit	Tolerance
4.	4.97 ± 0.02		
5.	1.0025 ± 0.0005		
6.	15.075 ± 0.001		

Compute the following. Use the correct number of significant digits.

7. $10.\underline{1}2 \text{ cm} + 0.0\underline{4} \text{ cm} =$ _____
8. $12\underline{8}.75 \text{ m} - 10.\underline{2} \text{ m} =$ _____
9. $12.5\underline{5} \text{ in.} + 4.17\underline{8} \text{ in.} =$ _____
10. $1.00\underline{6} \text{ lb.} + 12.5\underline{4} \text{ lb.} + 7.\underline{4} \text{ lb.} =$ _____
11. $10.1\underline{2} \text{ cm} \times 0.0\underline{4} \text{ cm} =$ _____
12. $128.7\underline{5} \text{ m} \div 10\underline{0} \text{ m} =$ _____
13. $12.5\underline{5} \text{ in.} \times 4.18\underline{7} \text{ in.} =$ _____
14. $1\underline{2}.54 \text{ lb.} \div 7 =$ _____

Define the following terms.

15. exact number

16. approximate number

17. upper limit

18. lower limit

19. tolerance interval

20. precision

21. accuracy

22. error in measurement

Draw a diagram to show each of the following.

23. precise but not accurate

24. both accurate and precise

25. neither accurate nor precise

UNIT 14: Solving Practical Problems with Powers and Roots

VIDEO

Problem: Radiology technicians use the inverse square law of radiation intensity to determine the distance from the radiation source. In this case, you will look at the reduction in distance from 40 feet to 20 feet and then again to 10 feet.

Given: Inverse square law of radiation intensity = _____

I = _____

D = _____

Original distance = _____

Solution

1. Write the inverse square law and evaluate it for a distance of 40 feet.

2. Use the same formula to calculate the intensity at 1/2 the distance or 20 feet.

3. Compare the difference between the intensity at 40 feet and 20 feet. The 20-foot intensity is _____ times _____ (larger/smaller) than the 40-foot intensity.

4. Repeat the procedure for 1/4 the distance or 10 feet.

5. Compare the difference between the 40-foot intensity and the 10-foot intensity. The 10-foot intensity is _____ times _____ (larger/smaller) than the 40-foot intensity.

6. In this inverse relationship, as the _____ increases, the _____ decreases.

Question

1. List three occupations shown in the video in which powers and roots are used.

   a.

   b.

   c.

UNIT 15: Using Formulas to Solve Practical Problems

VIDEO

Problem: You are asked to determine if the toaster and the teakettle can be plugged in to the same 15-amp circuit without blowing a fuse.

Given: Ohm's Law: _____

V stands for _____ and equals _____

R stands for _____ and equals _____

Procedure

1. You need to manipulate the formula to isolate the variable I.

2. Calculate the draw of the toaster using the manipulated formula.

3. Calculate the draw of the teakettle using the manipulated formula.

4. Add the draw of the teakettle to the draw of the toaster to find the total current for both appliances.

5. Will both appliances running on the same current line blow the fuse or will they run properly?

6. Write the four-step process for using formulas to solve problems as identified in the video.
   a.
   b.
   c.
   d.

REVIEW SHEET

Rewrite the formulas below so that the underlined variable is isolated.

1. $V = \underline{e}^3$
2. $A = 1/2\ \underline{b}\ h$
3. $V = \pi\ r^2\ \underline{h}$
4. $I = P\ \underline{R}\ T$
5. $V = \pi\ \underline{r}^2\ h$
6. $V = \underline{I}\ R$
7. $F = 9/5\ \underline{C} + 32$
8. $c^2 = a^2 + b^2$
9. $V = 4/3\ \pi\ r^3$
10. $D = \underline{r}\ t$

Solve the following problems.

11. Find the volume of a cylinder that has a radius of 7 feet and a height of 12.3 feet.

12. Find the other leg of a right triangle if the longest side is 36.9 cm and one of the legs is 13.4 cm.

13. Find the radius of a circle that has a circumference of 140 inches.

14. Convert 49°F to Celsius.

15. Convert 49°C to Fahrenheit.

16. Find the applied force along the direction of movement if the work done is 9,640 feet/pounds and the distance moved is 120 feet (W=FD).

17. Find the principal invested if the time is 12 years, the annual interest rate is 8%, and the interest amount is $850.00 (I=PRT).

18. Calculate the payment amount for financing a new car that cost $22,000.00 for 60 months at an annual interest rate of 7.25% (for monthly payments, i = 0.00583)

$$R = P\left(\frac{i}{(1-(1+i)^{-n}}\right)$$

R = the monthly payment
P = the amount of the loan (principal)
i = the decimal interest rate for each payment period (month)
n = the number of payments over the life of the loan

Police officers know that a car's speed and the road conditions affect a driver's ability to stop quickly. The braking distance is the distance traveled by a car from the instant the driver applies the brakes until the car comes to a complete stop. The following formula can be used to estimate the braking distance. Use the formula to solve numbers 19 and 20.

$$b = \frac{r^2}{30 \times F}$$

b = the estimated braking speed
r = the car's speed in mph
F = the driving surface factor, given in the table below

Type surface	Dry road	Wet road
Asphalt	0.85	0.65
Concrete	0.90	0.60
Gravel	0.65	0.65
Packed snow	0.45	0.45

19. What is the braking distance for a car traveling on dry asphalt at a speed of 55 mph?

20. At the scene of an accident, a car's skid mark indicates that it required 215 feet to stop completely on wet asphalt. Isolate r in the formula to find the estimated speed of the car.

UNIT 16: Solving Problems That Involve Linear Equations

STUDY GUIDE

Use the text to complete the following problems.

1. What is an equation?

2. List the three conditions that must be present for an equation to be linear:
   a.
   b.
   c.

3. What is a variable?

4. What is a constant?

5. What is an unknown quantity?

6. What is a numerical coefficient?

7. Given the following equation, identify the variables, constants, and coefficients.
   $9x + 15 = 3y$

8. Define identity.

9. Define false equations.

10. Identify each of the following as a one-answer, identity, or false equation.
    a. $z + 2 = 5$
    b. $3 + p = p$
    c. $2x/x = 2$
    d. $2y + y = 3y$
    e. $2z - 3z = 4z$
    f. $2y + 4 = 6$

11. Define conditional equations.

12. One way to show the pairs that satisfy an equation is to _____

_____.

13. Complete the following table by first simplifying the equation.

$2x + 4 = 6y$

x	y
0	
1	
2	
3	

14. The slope-intercept form of a line is _____.

15. How can the equation $y = 4x$ be put into slope-intercept form?

16. What information does the "m" give in the slope-intercept form of a line? What information does the "b" give?

17. What is the first step in solving the following equation for y?

$12x = 3y + 9$

18. Write each of the following equations in slope-intercept form.

a. $x + 6 = y - 4$

b. $9y = 9x + 27$

c. $8 - 3y = 9 + 4x - 4y$

d. $5y = -89x + 11(5 - x)$

e. $y = 17(2x + 3)$

f. $12y = 19x + 4y - 35x + 48$

19. Solve each equation below for y.

a. $13y + 92 = 20y - 6$

b. $41 - 4y = 1$

c. $y = 1250 - 4y$

d. $4y = 3y - 80$

20. Write an equation in slope-intercept form that has the given characteristics:

a. slope is 4.7 and y-intercept is 5.9 _____

b. slope is 1/2 and y-intercept is 4 _____

c. slope is 475 and y-intercept is −450 _____

UNIT 17: Graphing Data

STUDY GUIDE

Graph these special lines two at a time on the given axes. Label each line that is graphed with the equation of the line.

1. $y = -4$
2. $x = 0$
3. $y = 4$
4. $y = 0$
5. $x = -4$
6. $x = 8$
7. $x = 4$
8. $y = 8$

Graph these equations by plotting the y-intercept and using the slope to plot two more points. Put two on a single axis.

9. $y = 3x - 5$
10. $y = -2x + 3$
11. $y = -3x - 5$
12. $y = 2x + 3$
13. $y = 3x$
14. $y = -2x - 6$
15. $y = -3x$
16. $y = 2x + 6$

Read the descriptions of the lines and then graph them, two at a time, on the axes.

17. Graph the line whose slope is 3 and whose y-intercept is -2.
18. Graph the line that is parallel to the y-axis and whose x-intercept is 4.
19. Graph the line whose slope is zero and whose y-intercept is 4.
20. Graph the line that passes through the origin and has a slope of -2.

Rewrite the following equations in the form $y = mx + b$. Space is allowed for you to show your work. Write the steps to show what you are doing to both sides of the equation to solve for y.

21. $2x + y = 5$
22. $4x + 3y = 0$
23. $3y = 6x + 9$
24. $4x v - y = 3$
25. $2x = 3y + 6$
26. $2x - 3y - 6 = 0$

27–31. Graph the equations 21–26 in the form of $y = mx + b$.

UNIT 18: Solving Problems That Involve Nonlinear Equations

VIDEO

Problem: You are asked to determine if acceleration (a) of the space shuttle is greater than 3g, when g is 32 ft./sec.^{2}.

Given: $H = vt + \frac{1}{2}at^2$

Where H = _____

t = _____

v = _____

Procedure

1. Given the formula above, isolate a.

2. Substitute the given values into the equation and solve for a.

3. Determine the value of 3g if g is 32 ft./sec.^{2}.

4. Is the acceleration of the space shuttle greater than 3g?

STUDY GUIDE

1. Given the four graphs (a-d) on page 3, identify the slope for each line.

   a.

   b.

   c.

   d.

2. Identify the y-intercept for each graph on page 3.

   a.

   b.

   c.

   d.

3. How are nonlinear equations different from linear equations?

4. How does the graph of a nonlinear equation differ from that of a linear equation?

5. List four occupations where nonlinear equations are used.

6. Referring to the four graphs (a-d) on page 5, which part of the formula makes the equation nonlinear?

   a.

   b.

   c.

   d.

7. Given $y = X^2$, complete the table below.

x	$y = X^2$
0	
−1	
+1	
−2	
+2	
−3	
+3	

What happens to the sign when we square a negative number?

A shorter way to write this table would be:

x	$y = X^2$
0	0
±1	+1
±2	+4
±3	+9

8. Use a scale of 1 unit = ½ in. (2 boxes) on the Acculine to graph $y = X^2$ based on the results entered in the table for table 7 above.

9. What is this type of curve called?

10. If an equation can be written in the form _____, then its graph will be a parabola.

UNIT 19: Working with Statistics

TEACHERS NOTES

What is statistics?

1. Branch of mathematics to help collect, organize, and find meaning in numerical facts.
2. Refers to numbers themselves.

What is descriptive statistics?

Describes and summarizes collected numerical data; collected by counting and calculating.

What do you use descriptive statistics for? Give an example of descriptive statistics.
Question 2 TN-4—Sandra's batting average is a good discussion question.

To predict what may happen in the future on the basis of the past.

What is inferential statistics?

To make a prediction about the *whole* by using *part*; inferring something.

When do you use sampling?

When you can't count everything.

What do you assume when you use sampling?

That the sample accurately represents the whole.

Does it matter whether or not it does? Yes.

Why? You will get a wrong prediction if the sample is not accurate.

Good discussion questions on TN-5

Statistics	part—whole
Probability (looking to Unit 20)	whole—part

Discuss three work situations from the video.

How do manufacturers use sampling for quality control?

Test every 100th toaster to monitor quality and production problems.

How do ecologists use sampling for levels of fish population in a lake?
Questions on page 6 are good thinking questions for students. Also, ask students questions on TN-6.

Statistics can both describe weather, business conditions, and crops and their prices, as well as predict weather, prices, and other conditions for the future.

Start off asking questions on TN-7.

Supermarket wants to know what cereal brand sells most?

Central tendency

Real estate salesperson is interested in knowing the middle selling price for a 3BR house. At what price did A have the same value above as below?

Central tendency

Students want to know average of test scores.

Central tendency

Remember: Measures of central tendency use just one number to represent all numbers in data.

Mathematical terms for measures of central tendency:

Mode—most popular
Median—middle (think of median in road)
Mean—average

Use Example 1 (without students seeing it). Shows which letters occur most.

Organize to show which six letters occurred *most* and *just* arranged data to show frequency.

- Shows
- Organize
- Just

TN-8 offers different experiences for practicing tallying.

Frequency used for Wheel of Fortune—Table 19-1.
Who else would use information such as Table 19-1?

People who design and break codes and ciphers.

Would the frequency of letters be the same for other languages?

Study Activity on page 9 is good.

Use Table 19-2 to develop a frequency distribution. Organize the information into a more meaningful form similar to organizing Table 19-1, using numerical rather than alphabetical statistics.

Study Activity on page 11 is good.

To describe mean, median, and mode, use phrases on TN-11.

Frequency Distribution Table helps answer "Which number occurs most?"

Looking at Table 19-2 for Worker A, which number occurs most?

5

For Worker A, the mode is 5 items of clothing per day.

Do all sets of numbers have a mode? No (example 3)

Do all sets of numbers have more than one mode? Yes (example 4)

A set of numbers may have no mode, one mode, or more than one mode.

When would you use the mode?

To measure the central tendency of a large amount of data when you want to find the most characteristic value in the group.

Mode is another word for fashion or style.

TN-12 is good. Discuss statements with students.

Give an example of where mode might be used.

Example 5—Median divides the group in half—same marks above as below. Does not necessarily need to be a number in the data.

If the median falls between two measures, use the point that is halfway between them.

Study Activity, page 14—Drives home the fact of having an extreme value affect the *mean* but not the *median*. "How to Lie with Statistics" is good discussion point following this activity.

Example 6 has good questions for discussion after working through example.

Study Activity, page 15—Develop a table using three measures of central tendency for three workers.

Study Guide, page 16—Help supervisor determine which worker to keep.

Good discussion in TN-16

REVIEW ON PAGE 17—Let's discuss what we've learned.

TN-17 has good ideas to determine which measure to use.

Variability—how the numbers vary

Range—difference of largest to smallest
Discuss TN-18 to show range and spread.

Example 7—Find range for A.
Study Activity, page 19—range for B and C
Range shows consistency in production—negative indicators to supervisor.

Study Activity, page 19—trend being using to examine production
Question at bottom of page 19—good for trend
TN-19 deals with confidence in decisions based on trend.

Study Activity, page 20—Read paragraph to explain. TN-20 shows how to set up frequency table and guidelines. Guidelines to graph frequency table is on page 20 at the bottom of page.

Discuss differences between histogram and regular graph.

1. Does x-axis begin at 0?
2. Rectangle instead of points?

Normal curve from histogram

What facts are true about a normal curve?

1. Mean, median, and mode are same.
2. Curve is same shape on both sides.

TN-22—Good discussion
TN-23—Use transparencies to discuss how to make a normal curve from histogram.

Where is the inflection point?

Sliding down the curve where it switches from getting steeper to getting less steep.

What is a standard deviation?

The area under the curve that is from the center line to the vertical line through the inflection point.

The following examples are good, but not all need to be used:

Examples: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 17, 18, 19, 21, 22, 23, 25, 26, 29.

For exercises, students need to know characteristics of a bell curve.

UNIT 20: Working with Probabilities

STUDY GUIDE

1. Probability uses information about the _____ to predict information about a _____. It works the opposite of _____.

2. The mathematics of probability helps you measure _____.

3. The probability of an event happening equals _____
   _____
   _____

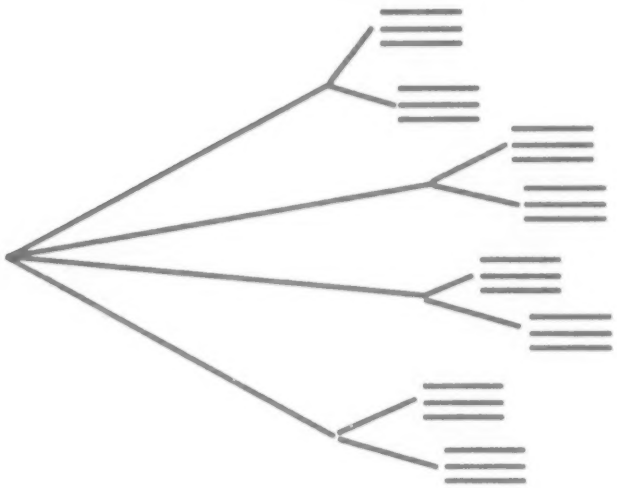
4. The probability of an event that is sure to happen is _____.

5. The probability of an impossible event is _____.

6. Gambling is one minor application of probability. Probability is important in a wide range of fields such as _____, _____, _____, _____, _____, _____, _____, _____, and _____.

7. In order to find probabilities, you often have to _____ _____ that an event can happen.

8. Draw a tree diagram that would determine all the different ways you could dress if you had the following clothes:
   Blouses—striped, white, blue, red
   Skirts—blue, black
   Shoes—heels, sandals, leather flats



9. Another way of determining all the possible ways to dress is by _____ the _____ numbers together.

10. The name for finding the number of ways to make successive choices in a series of different categories is _____.

11. The number of ways to use c objects to fill p positions (when order makes a difference) is _____.

12. If there are 5 chairs at the head table (p=5) and 10 people to choose from (c=10), how many different arrangements can there be at the head table?

    _____

    Use (c) (c-1) (c-2) (c-3) (c-4) (c-5) (c-6) (10) (9) (8) (7) (6) (5) (4) = _____

13. Look at Figure 20-8 on page 14 and determine the probability for getting a red flowering plant, a white flowering plant, and a pink flowering plant.

    _____

    _____

    _____

    _____

14. Make a chart that will determine the seedlings of a cross between a red parent plant and a white parent plant.

15. From the chart in problem 14, determine the probability of a pink plant.

_____

_____

_____

_____

16. Odds are determined by comparing the number of _____ ways with the number of _____ ways.

    Odds in favor of an event _____

    _____

    _____

17. If the chances of an event happening are the same, we call this _____

    _____.

18. Probability of an event is always a fraction between _____ and _____ and can never be a number _____ or _____.

19. The probability that an event will happen, added to the probability that the same event will not happen, is always _____.

20. All the probability problems that you have seen in this unit have been problems in _____

    _____.

21. When one event is as likely to happen as another, we say these events are _____

    _____.

22. The formula for determining probability is only for outcomes that are _____

    _____.

23. Results are _____ if they cannot both happen at once.

24. If event A and event B are mutually exclusive, then the probability of either A or B happening is the _____ of the two probabilities.

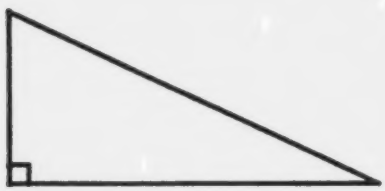
UNIT 21: Using Right-triangle Relationships

1. Define a triangle.

2. Define a right triangle.

3. Are all triangles right triangles? If not, what are they called? _____

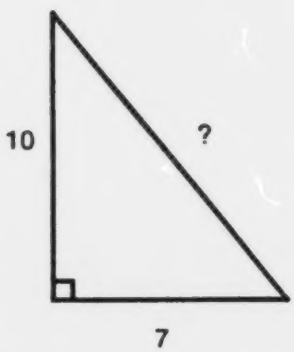
4. Label all parts of this triangle, assuming it is a right triangle.

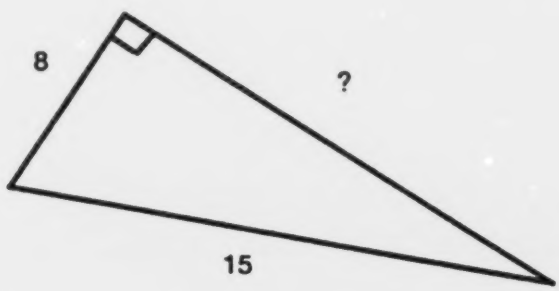


5. a. State the Pythagorean theorem in English words (if–then).

   b. State the Pythagorean theorem algebraically.

6. Use the Pythagorean theorem to solve the missing side in each triangle.





7. Write the converse of the Pythagorean theorem (if–then).

8. Why does a triangle whose sides are 3, 4, and 5 form a right triangle?

9. Write ten triplets of 3, 4, 5.

10. List another triplet other than 3, 4, 5.

11. What is an acute triangle? What is an isosceles triangle?

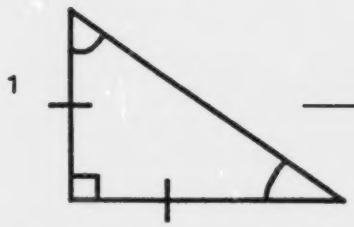
12. Name an important result of an isosceles triangle.

13. Label this isosceles triangle.

14. $\sqrt{2}$ = ?

    $\sqrt{3}$ = ?

15. What is triplet for a $45° - 45° - 90°$ isosceles right triangle?



16. Find the missing side if each triplet represents the sides of a right isosceles triangle (ley, beg, hyp).

    (2, 2,) (8, 8,)

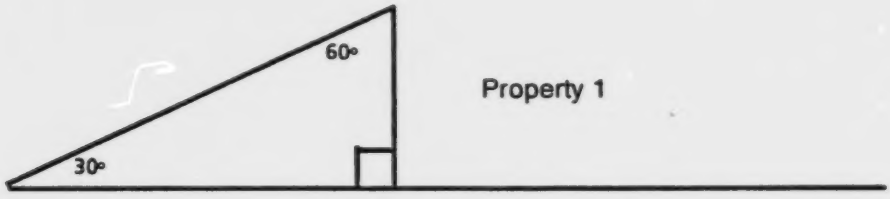
    (5, , $5\sqrt{2}$) (, , $10\sqrt{2}$)

17. Find the diagonal of a 1 m square.

18. If the diagonal of a square is 5, find the measure of a side.

19. Find the diagonal of a shoe box 6 inches by 5 inches by 14 inches.

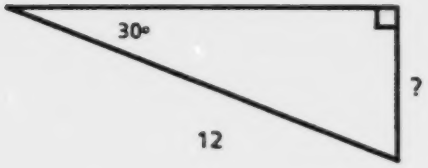
20. 30° – 60° – 90° triangle: Property 1

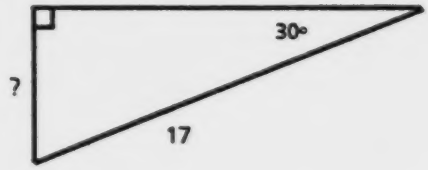


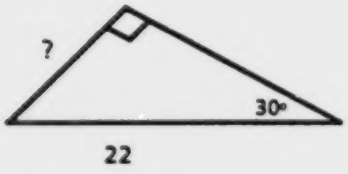
Property 1

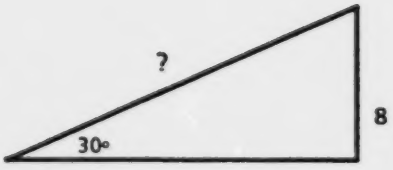
Smallest side (leg) is ½ the hypotenuse.

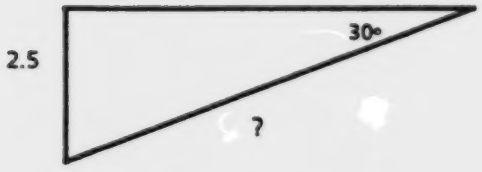
Find the indicated side.







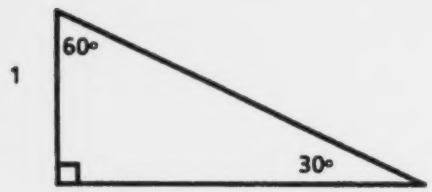




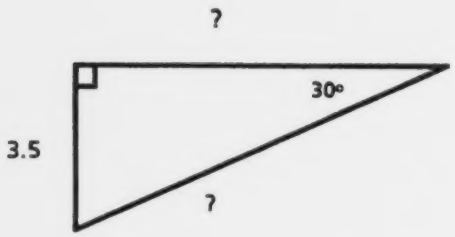
21. 30° – 60° – 90° triangle: Property 2

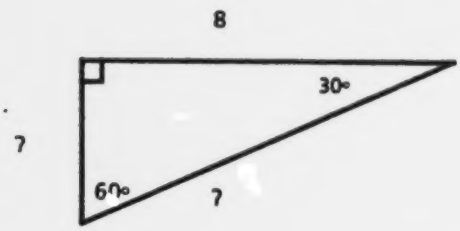
The third side is least side times $\sqrt{3}$.

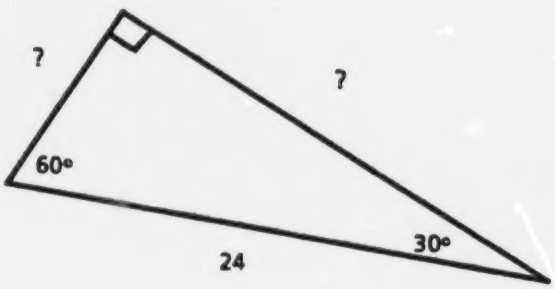
What is the triplet for this 30° – 60° – 90° triangle?



Find the missing side.



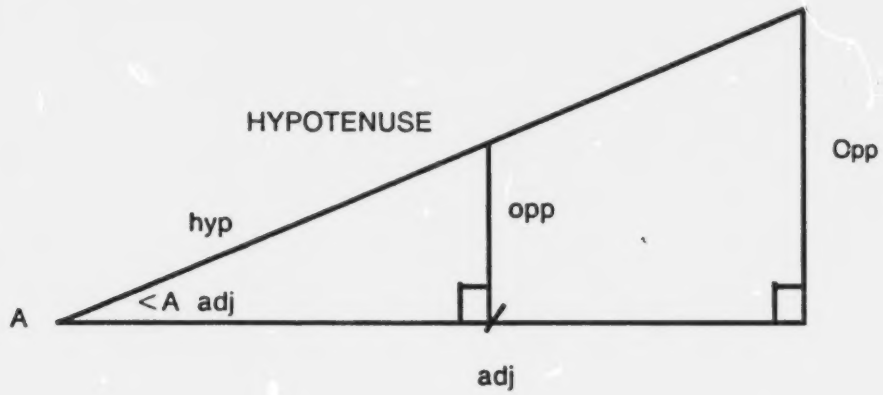




22. Define similar triangles.

23. What is a proportion?

24. If two triangles are similar, the corresponding sides can be used to form a _____.



For any size triangle which contains <A and the right angle, which ratios do we use for trigonometry?

$$\sin < A = \frac{\text{opp}}{\text{hyp}} = \frac{\text{OPP}}{\text{HYP}}$$

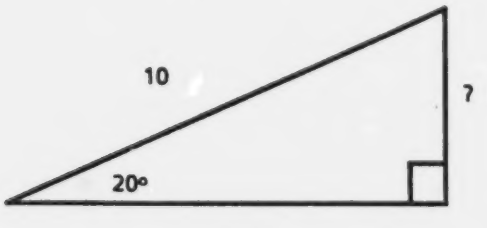
$$\cos < A = \frac{\text{adj}}{\text{hyp}} = \frac{\text{ADJ}}{\text{HYP}}$$

$$\tan < A = \frac{\text{opp}}{\text{adj}} = \frac{\text{OPP}}{\text{ADJ}}$$

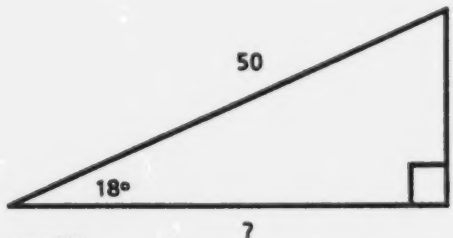
21. Use your calculator to complete the chart:

	sine		cosine		tangent
0°		0°		0°	
15°		15°		15°	
30°		30°		30°	
45°		45°		45°	
60°		60°		60°	
75°		75°		75°	
90°		90°		90°	
135°		135°		135°	
180°		180°		180°	
270°		270°		270°	
300°		300°		300°	
330°		330°		330°	

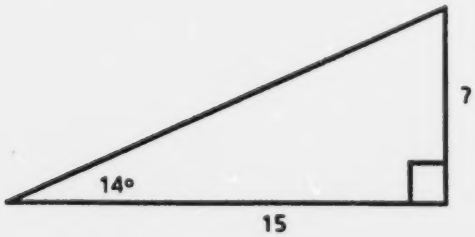
27. Solve using given trig ratio.



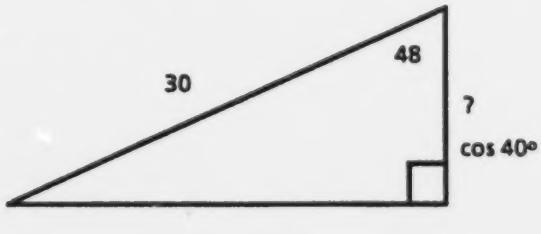
sin 20°



cos 18°



tan 14°



cos 40°

FLORIDA TEACHING SUPPLEMENT

APPLIED MATHEMATICS

LAB ACTIVITIES

UNIT B: Naming Numbers in Different Ways

LAB ACTIVITY 1: Finding the Percentage of Wall Space

Equipment Needed: Tape measure
Calculator

Given: Heat energy is gained and lost more easily through window glass than wood or masonry walls. The greater the percentage of window space in an exterior wall, the greater the heat gain will be in the summer and the heat loss in the winter. This causes the cost of heating and cooling to increase with the percentage of window space.

Problem: Find the area of exterior walls, interior walls, and windows in your classroom. Exterior walls separate the inside of the building from the outside. Interior walls separate the rooms of the building from each other and from hallways.

Procedure:

1. Draw a rough sketch of your classroom on the back of this paper. Identify the location of the interior walls, exterior walls, windows, and doors.

2. Measure the length and width of the walls, windows, and doors. Label your sketch with these measurements.

3. Compute the wall space (the area) for each wall in your classroom. Remember that the area of a surface is calculated by multiplying the length by the width.

   Area of:

   East wall = North door =

   West wall = South door =

   North wall = North window =

   South wall = South window =

4. Compute the total wall space by adding the area of all walls (not windows and doors).

   Total wall space = _____

5. What fraction of the total wall space is the exterior wall space?

$$\frac{\text{Exterior wall space}}{\text{Total wall space}} = _____$$

6. What fraction of the total wall space is the interior wall space?

$$\frac{\text{Interior wall space}}{\text{Total wall space}} = _____$$

7. Compute the following:

Total window space in the room = _____

$$\frac{\text{Exterior window space}}{\text{Total window space}} = _____$$

$$\frac{\text{Interior window space}}{\text{Total window space}} = _____$$

8. Compute the following:

Total door space in the room = _____

$$\frac{\text{Exterior door space}}{\text{Total door space}} = _____$$

$$\frac{\text{Interior door space}}{\text{Total door space}} = _____$$

9. Compute the following:
   a. What percent of the total wall space is interior wall space?_____
      (Hint: To do this, convert the fraction from question 6 into a decimal and then make the decimal a percent.)
   b. What percent of the total wall space is exterior wall space?_____
   c. What percent of the total wall space is window space?_____

10. a. If there are windows in any of the interior walls of your classroom, do you think that this would have an effect on the heating and cooling of the classroom? Why or why not?

    b. Using your knowledge of the wall space in your classroom, what suggestions could you make to the school district to improve the efficiency of heating and cooling the rooms?

UNIT B: Naming Numbers in Different Ways

LAB ACTIVITY 2: Calculating Free-throw Percentages

Equipment Needed: Basketball hoop and ball
Free-throw line
Calculator

Given: Percents and their decimal equivalents often are used to measure athletic performance. Batting averages in baseball are a decimal equivalent of a percent. Team performance is also measured this way. Basketball skill also is reported as a percentage.

Problem: Find your free-throw performance.

Procedure:

1. After taking several practice shots, make 12 shots at a free-throw and record your performance below.

   I made _____ shots out of 12 attempts.

2. What fraction of shots did you make?

3. What decimal number is this fraction?

4. What percent does this decimal number represent?

5. What percent of the shot attempts did you miss?

6. a. If you continued to perform at this level, how many shots would you make if you attempted 35 shots? (Hint: Write this as your percentage of 35 attempts, and then compute your answer.)

   b. If you attempted 85 shots, what number would you expect to make?

7. On the back of this paper, list each student in your class and the number of free throws he or she made out of 12. Calculate the fraction of shots made by the total class.

8. What percent of the shots did your class make?

9. If the class tried a total of 650 shots, about how many would the class make?

10. Would it make a difference in the class percent if the girls were allowed to only shoot one of the 650 shots and the boys were allowed to take the rest of the shots?

11. Would it make a difference in the class percent if the boys were allowed to only shoot one of the 650 shots and the girls were allowed to take the rest of the shots?

12. A major league batting average of .350 gets a lot of attention. What does the number .350 mean?

13. What percent does .350 mean?

14. How many hits would a batter have who was at bat 100 times and had an batting average of .350?

15. Does the batting average of .350 also mean that the same batter will make the same number of hits in the next 100 times at bat? Why or why not?

UNIT C: Finding Answers with Your Calculator

LAB ACTIVITY 1: Material Estimates and Costs

Equipment Needed: Measuring tape
Price list for PVC pipe
Chalk

Given: Your plumbing company has been asked to submit a bid to the school board. The most complete and lowest priced bid package will be awarded the contract. You need to run a temporary cold-water pipe from the nearest water fountain to the wall behind the teacher's desk. The pipe should run along the floor next to the wall and through the doorway. Determine how many 10-foot sections of $^3/_4$-inch PVC pipe, straight joints, and 90-degree elbows are needed. Then figure how much the materials for the cold-water pipe will cost and what the labor costs would be.

Procedure:

1. Walk with your group from the teacher's desk to the nearest water fountain. You will need to make a rough sketch as you go along. Draw in all the straight lines and the 90 degree turns you will need to make.

2. Using the measuring tape, measure the distances on your sketch. Be sure to label the sketch accurately.

3. Calculate the number of 10 foot sections you will need to complete the job. Count the number of straight joints and the number of 90-degree elbow joints needed.

   The number of 10-foot sections needed is _____. They cost _____ each for a total of _____.

   The number of straight joints needed is _____. They cost _____ each for a total of _____.

   The number of 90-degree elbows joints needed is _____. They cost _____ each for a total of _____.

   The total cost for all material is _____.

4. Assuming a labor cost of $25.00 per hour, estimate the number of hours it might take to complete the job.

   Labor costs: _____ hours at $25.00 per hour = _____

5. Attach your sketch to your copy of the bid you will submit to the school board for your company. (Remember to label your sketch completely).

UNIT C: Finding Answers with Your Calculator

LAB ACTIVITY 2: Cross-Country Vacation

Equipment Needed: Map calculator

Given: You are going on a cross-country vacation by car. A road map shows distances between the cities you will pass through. You need to know:

- how many miles you will drive
- how long the drive will take
- how much gasoline you can expect to use
- when you can expect to arrive at your destination
- how long you can stay
- what your trip will cost

Procedure:

1. Your trip will begin in San Antonio, Texas, and go to Seattle, Washington.

2. Examine the road map and notice the information that is shown. Major cities are identified. The distances between cities along the interstate highways are also included.

3. On a piece of paper, write the name of the city from which your vacation trip begins, San Antonio, Texas. Looking at the map, determine the route you would like to take. Follow the map route with your finger. Write the name of the next city you'll come to in route to your destination. Compute the mileage between the two cities and record it on your paper.

4. Move your finger along the map route to the next city. Write the name of this city beneath the others and the mileage beside the city's name. Continue this procedure until you finally reach your destination city, Seattle, Washington.

5. What is the total number of miles between the start and finish of your vacation trip? Write this number on your paper and circle it.

6. What is the speed limit on the highways that you plan to travel? Write this on your paper. How did you determine your answer?

7. Traveling at this speed, how many driving hours will it take to travel the total distance from start to finish for your trip to Seattle? Write this on your paper.

8. If you assume that your car averages 25 miles per gallon, how many gallons of gasoline will you need to purchase for your trip? Write this on your paper.

9. Since the trip is of great distance, you probably will not drive without stopping for meals, rest, and gasoline. Use the following information to figure out how much additional time should be added for these delays.

   Rest stops are made every 150 miles and last 10 minutes.

   Gasoline stops are made every 300 miles and take about 15 minutes.

   Lunch stops are made near 12:00 p.m. and last 45 minutes.

   Overnight stays are made after about 12 hours of driving. Assume that overnight stays include the evening meal and the morning meal, and this takes 12 hours.

   Write these categories down and the time needed for each category next to it. Find the total number of non-driving hours, and circle it.

10. Add the total driving time needed and the total non-driving time needed. Circle your total.

11. If you leave for your trip on Saturday morning at 7:00 a.m., what date and time would you expect to arrive at your destination in Seattle? Write this information on your paper.

12. Using the chart below. Figure out how much this trip might cost:

Gasoline	$ 1.20 per gallon
Breakfast	4.00
Lunch	6.00
Dinner	9.00
Overnight Stay	30.00

   • Write on your paper how many gallons of gas you will need and its total cost.

   • Calculate the number of meals, types of meals, and total cost for each type of meal on your paper.

   • Calculate the number of overnight stays you will need to take and the total cost.

   • Record the answer on your paper. Add all costs and circle the total.

13. If you only have two weeks for this vacation and you leave on Saturday, the 12th, on what day will you have to leave Seattle to return to San Antonio by Sunday, the 26th? How many days will you spend in Seattle? Write these figures on your paper.

UNIT 1: Learning Problem-solving Techniques

PRE-LAB 3 INFORMATION: Designing a time-measuring device

CAUTION: We will be using a plumb line to act as a pendulum. Take care when handling the plumb bob because it has a **VERY SHARP EDGE.**

You are responsible for knowing the terminology related to pendulums listed below. Please read carefully and memorize.

"Swing" (complete swing) of a pendulum - a back and forth cycle. It will be demonstrated for you. You will be counting complete swings in the lab.

Period of a pendulum - length of time for one complete swing made by a pendulum.

Even though the length (distance) of the swing of a pendulum's arc decreases, the PERIOD STAYS NEARLY CONSTANT. We are going to use this theory to design a simple device for measuring short periods of time. The device will be rugged, portable and inexpensive. We will be using a plumb line and bob to act as a pendulum.

Because it is difficult to measure accurately the length of time for one complete swing of a pendulum, we will be using a stopwatch to measure the time required for ten complete swings. Then we'll divide this time by ten to find the length of time for one complete swing.

We will vary the length of the pendulum from 3 to 12 inches, in increments of one inch, and determine the period (length of time for one complete swing) in seconds.

Our purpose is to find the length needed to have a complete swing that lasts one second. Once we have found the correct length, we will use our new timer, along with a stopwatch, to time an activity and determine if our new timer is accurate.

Within your group, decide the following jobs for tomorrow's lab:

Timer

Counter

Recorder

Swinger or holder

LAB ACTIVITY 3: Designing a time-measuring device

Equipment Needed: 1 stopwatch
1 plumb line and bob
1 yardstick
1 lab sheet

Procedure:

1. Prepare the plumb line and bob to act as a pendulum. Use demonstrated method for pendulum swings.

2. Using the stopwatch, time 10 swings for each measured length of line. You will be using lengths of 3 inches to 12 inches, in 1-inch increments. For each length, record the following in the table below:
   a. the pendulum length
   b. the time for 10 complete swings in seconds
   c. the period in seconds

3. Complete the following chart:

PENDULUM LENGTH (in inches)	TIME FOR 10 COMPLETE SWINGS	PERIOD (TIME FOR 1 COMPLETE SWING)
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____
8	_____	_____
9	_____	_____
10	_____	_____
11	_____	_____
12	_____	_____

4. Which length of line gives you a period of 1 second? _____

5. You are going to time the running activity. Have someone in your group agree to do 25 steps running in place. One person in you group will use the pendulum (the length that has a period of 1 second), and one person will use a stopwatch to measure how long the exercise takes. Compare the result of your pendulum clock to the result of the stopwatch. How accurate was the pendulum? How many seconds did it differ from the stopwatch? _____

UNIT 2: Estimating Answers

LAB ACTIVITY 1: Estimating Distances

Equipment Needed: Measuring tape
Calculator
Stopwatch

Problem: You are asked to find your estimated step length and your average feet per second. You will use this information to estimate the length of the hallway, the perimeter of the building, and the time needed to walk ten miles.

Procedure:

1. Mark off a distance of 100 feet in the hallway. Walk the distance three times, recording the number of steps required to cover the 100-foot distance. Have a member of your group use the stop watch to find the time required for you to walk the distance. Record your values below:

   Number of steps: Trial 1 _____ Trial 2 _____ Trial 3 _____

   Time per 100 feet: Trial 1 _____ Trial 2 _____ Trial 3 _____

2. Find the average number of steps you needed to cover the 100-foot distance by adding the three trials and dividing by three.

   $$\frac{\text{------} + \text{------} + \text{------}}{3} = \text{_____ average number of steps}$$

3. Find your average step length by dividing the 100-foot distance by the calculated average number of steps.

   100 ft / _____ average number of steps = _____ ft/step

4. Calculate the average time you needed to cover the 100-foot distance by adding the three trials and dividing by three.

   $$\frac{\text{------} + \text{------} + \text{------}}{3} = \text{_____ average sec}$$

5. Find your average number of feet per second by dividing the 100-foot distance by the average number of seconds you needed to cover the distance.

   100 ft / _____ average seconds = _____ ft/sec

6. Calculate the average number of feet per minute you walk by multiplying your average feet per second by 60 seconds per minute.

_____ ft/sec x 60 sec/min = _____ ft/min

7. You now have all the information you need to estimate the length of the hallway. Begin at one end of the hallway and walk the distance counting your steps as you go. Have your partner time the walk. Record the number of steps and minutes below. Multiply the number of steps you counted by your feet per step (calculation on page 1) to get the distance. Then multiply the time in <u>minutes</u> by your feet per second (calculation on page 1) to estimate the distance. Compare your two answers.

_____ steps x _____ ft/step = _____ ft

_____ min x _____ ft/min = _____ ft

Are your answers close? _____

What is the difference between the two estimates? _____

8. Estimate the distance around the building by using the time method. Using a stopwatch, find the time required for you to walk around the building. Multiply the time (minutes) by the feet per minute to estimate the distance.

_____ min x _____ ft/min = _____ ft

9. Compute the estimated time to walk ten miles. Use the number of feet in ten miles divided by your feet per minute to estimate your answer.

_____ ft/mi x 10 mi/ _____ ft/min = _____ min

10. Can you give an explanation for the difference in distances you computed for the hallway?

11. What other practical applications arise if we can calculate distance without measuring?

UNIT 2: Estimating Answers

LAB ACTIVITY 2: Estimating bleacher capacity

Equipment Needed: Measuring tape
Calculator

Problem: You will need to estimate the number of people who can be seated in the bleachers on one side of a basketball gymnasium or a football field.

Procedure:

1. Use a measuring tape to mark off a section of bleachers 10 feet long. Using other students in your class, find the number of students that can sit comfortably in this 10-foot section.

   _____ students per 10 foot section

2. Step off the total length of the bleachers by walking from one end to the other. Count your steps as you go.

   _____ steps for the entire bleacher

3. Estimate the length of the row of bleachers by multiplying your step length (ft per step) by the number of steps you counted for the section.

   _____ ft/step x _____ steps/row = _____ ft/row

4. To find the total number of people that can sit comfortably in the bleachers, you need to know the number of feet in all the rows. Count the number of rows and multiply by the length of the bleachers.

   _____ rows x _____ ft per row = _____ ft in all rows

5. Find the total number of 10-foot sections by dividing the total length in all rows by 10 feet.

   _____ ft in all rows ÷ 10 ft = _____ 10-ft sections

6. Since you know how many people can sit comfortably in a ten-foot section and you have found the number of ten-foot sections in the bleachers, you can now multiply to find the answer to the problem presented.

_____ people per 10 ft x _____ 10-ft sections = _____ people

7. Estimate the average weight of an adult person. Use this estimate to calculate the total weight supported by the bleachers when there is a full crowd at a game. Show your calculations below.

8. Do you consider your estimate to be accurate? Is this estimate high or low? Explain.

UNIT 3: Measuring in English and Metric

LAB ACTIVITY 3: Measuring areas

Equipment Needed: Yardstick or tape measure marked in feet
Meter stick or tape measure marked in meters
Pencil and paper
Accu-Line
Calculator

Part I - Measure the length and width in both feet and meters of the following areas:

1. the classroom - width is the measurement from front to back of room; length is the measurement across the room.
2. the shelf of the TV cart
3. the countertop at the side of the room

Write your measurements in feet (only) and meters in the appropriate spaces below:

Measurement in feet	Measurement in meters
length of classroom _____	length of classroom _____
width of classroom _____	width of classroom _____
length of shelf _____	length of shelf _____
width of shelf _____	width of shelf _____
length of countertop _____	length of countertop _____
width of countertop _____	width of countertop _____

Part II - Determine your conversion factors:

1. **Divide your length measurement of each item in feet** by your **length measurement of each item in meters.**

   classroom = _____ Conversion factor - meters to feet

   shelf = _____ Conversion factor - meters to feet

   countertop = _____ Conversion factor - meters to feet

2. Compare these conversion factors. Are they the same?

3. Look on page 17 in your book and write the conversion factor for 1 meter = _____ feet.

   Are your conversion factors the same as the conversion factors on page 17?

4. Now use your width measurements to determine conversion factors for feet to meters. **Divide your width measurement of each item in meters by your width measurement of each item in feet.**

   classroom = _____ Conversion factor - feet to meters

   shelf = _____ Conversion factor - feet to meters

   countertop = _____ Conversion factor - feet to meters

   Compare these conversion factors. Are they the same?

5. Look on page 17 of your book and write the conversion factor for 1 foot = _____ meters.

   Are your conversion factors the same as the conversion factor on page 17?

UNIT 3: Measuring in English and Metric Units

LAB ACTIVITY 4: Body weight/Medicine Dosage

Equipment Needed: Bathroom scale

Problem: As a nurse or pharmacist, you may be required to compute the dosage required for a prescribed medicine to be given to a patient. You have found that most medicines are prescribed using a ratio of units to kilograms of body weight. The weight of the patient is given in pounds. It is your responsibility to convert the body weight to kilograms and then calculate the correct dosage of medicine.

Procedure:

1. Weigh a "patient" using the bathroom scale and record the weight in pounds. Convert the weight to kilograms using the correct conversion ratio.

   Patient's weight in lbs. = _____

   Patient's weight in kg = _____

2. Compute the dosage for each of the following medicines you may need to give the patient.

   Drug: Penicillin
   Dosage: 10,000 units/kg per day
   Given: 4 times per day
   Correct dosage: _____

   Drug: Elspar
   Dosage: 1,000 units/kg per day
   Given: 2 times per day
   Correct dosage: _____

   Drug: Dilantin
   Dosage: 5 mg/kg per day
   Given: 3 times per day
   Correct dosage: _____

3. What effect could an error in the conversion of the patient's body weight in pounds to kilograms have on the health of the patient?

4. What other uses might a nurse have for understanding the metric conversion concepts?

UNIT 4: Using Graphs, Charts, and Tables

LAB ACTIVITY 2: Comparing Breakfast Cereals

Equipment Needed: Accu-Line
Felt-tip markers (three colors)
Labels from three different cereal boxes that list nutritional content

Problem: In this activity, you are asked to compare the amount of carbohydrates, fats, and proteins in a single serving of three different cereals. You will be making the comparisons for the cereal: (a) without milk and (b) after one-half cup of milk has been added. You will be able to answer the questions listed below after you have graphed the data you collect.

Procedure:

1. Organize the nutritional content on the cereal box into three tables. Be sure to list the nutritional content for the cereal with and without milk. An outline of the tables is provided below:

Cereal Name	without milk	with milk
protein		
fat		
carbohydrate		

2. Choose a title that describes each graph.

3. Choose labels for the bottom and left axis of each graph. Pick a color to represent each of the cereals on your graph.

4. Choose units for the left side of your graph. Remember to observe the range of your data before you choose the units. Decide how long each axis must be to represent your data clearly.

5. Use the Accu-line drawing kit to draw your graph. Be sure to label all parts completely. Include a key or legend to show what cereal is represented by which color.

Answer these questions after the data has been graphed:

a. Which cereal without milk has the most protein?

b. Which cereal with milk has the most protein?

c. Which cereal without milk has the most carbohydrates?

d. Which cereal with milk has the most carbohydrates?

e. Which cereal without milk has the most fat?

f. Which cereal with milk has the most fat?

g. What nutrients are added by the milk?

h. Is there a nutrient that is present in the cereal served with milk that is not present when it is served without milk? If so, which nutrient?

UNIT 6: Working with Lines and Angles

LAB ACTIVITY 1: Angle of stairs

Equipment Needed: Plumb line
Line level
String
Protractor
Measuring tape
Accu-Line drawing kit

Problem: The school has encountered opposition to the steepness of the stairs. They have asked this class to verify the angle of the stairs to be sure that it complies with the school board policy and local ordinances.

Procedure:

1. First, practice with the line level and plumb line to set up horizontal and vertical lines. Two members of the group should hold the string with the line level taut (so there is no sag). Raise or lower one side of the string so that the line level balances with the bubble in the middle. Use the plumb line to establish a vertical/horizontal line. Using a protractor, measure the angle formed. It should be a 90-degree angle.

2. Go to the stairs that you are to investigate. Have one member of the group take one end of the string to the top of the stairs and have another member hold the string at the bottom of the stairs so that the string forms a straight line from the top edge of the highest step to the floor at the base of the stairs.

   Two group members need to establish the horizontal reference line with the line level at a height of six inches from the floor at the base of the stairs. The fifth member of the group drops the plumb bob to establish a vertical reference line at the same place where the other two strings cross at the base of the stairs. Measure the angle formed by the vertical line and the string on the staircase.

3. What is the angle of rise? _____

4. Does the handrail have the same angle of rise? Use the same string procedure to find the angle of rise for the handrail.

   Angle of rise for the handrail is _____.

5. Suppose the staircase you have just measured is replaced by a longer set of stairs. The new stairs extend out 2 feet farther along the floor. Given this information, use the string and protractor to find the new angle of rise for the extended staircase.

   The new angle of rise for the extended staircase is _____.

6. Using the Accu-Line drawing kit, draw a scaled drawing of the triangle formed by the staircase you just measured. To do this, you need to know the height of the top stair from the floor, the distance from the place where the string touches the floor to the top stair, and the angle of rise.

   How can you find the distance from the top stair to the floor?

   How can you find the distance from the top stair to where the string touches the floor?

7. Complete a second drawing which shows the extended staircase as described in question 5.

UNIT 6: Working with Lines and Angles

LAB ACTIVITY 4: Surveying a Plot of Land

Equipment Needed: Drawing paper
Ruler
360° protractor
Calculator

Problem: Use the results of a land survey to plot the points that represent the four corners of the lot, four corners of the house on the lot, and the two points representing the water meter and the electrical supply pole.

Scale for the drawing: 1 inch = 16 feet

Angles are measured relative to North (which is the top of the paper).

The lot's location is measured relative to a known position called a "benchmark."

1. Place the benchmark (a single dot) 1 inch from the top of the paper and 1 inch from the right edge of the paper.

2. Plot the NE corner of the lot:

   located 31 feet at 210° from the benchmark

3. Starting at NE corner, plot the four corners of the lot.

   a. 80 feet from NE corner at 270° (the NW corner of the lot)
   b. 100 feet from NW corner at 185° (the SW corner of the lot)
   c. 104 feet from SW corner at 086° (the SE corner of the lot)
   d. 96 feet at 350° (back to the NE corner of the lot)

4. Starting at NE corner of the lot, plot the four corners of the house.

   a. 37 feet from NE corner of the lot at 223°(NE corner of the house)
   b. 31 feet from NW corner of the lot at 152° (NW corner of the house)
   c. 47 feet from the SW corner of the lot at 030° (SW corner of the house)
   d. 53 feet from the SE corner of the lot at 309° (SE corner of the house)

5. Plot the points for the utilities:

   a. Water meter is 11 feet from the NW corner of the lot at 145°.
   b. Electrical supply pole is 50 feet from the NE corner of the lot at 207°.

6. What is the area of the house in square feet? _____

Bonus: What is the approximate area of the lot in acres? _____
(1 acre = 43,560 sq. feet)

UNIT 5: Dealing with Data

LAB ACTIVITY 4: Analyzing and interpreting data

Problem: You have been given a topic of interest by your teacher. You need to determine what data you need, collect the data, organize it, and then prepare an interpretation of the data to be given in class.

Procedure:

1. Determine what data is needed. List all data needed below.

2. Find a source for you data. Record your sources below.

3. Make a survey form for your data. Attach a copy of the survey to this paper.

4. Design a data collection method (tally sheet) and record your results for the survey on the tally sheet.

5. Organize your data for presentation. Write a short (3-5 minute) speech outlining your findings. Include an outline for all steps in completing this activity. Attach the outline to this paper.

6. Schedule your presentation with your teacher.

UNIT 7: Working with Shapes in Two Dimensions

LAB ACTIVITY 1: Laying Out a Foundation

Equipment Needed: String
Yardstick
Scissors
4 small bathroom cups
Straws
Sand
Felt tip pen

Problem: In this activity, we will simulate the layout of a foundation for a rectangular shed. The foundation should be a rectangular slab 12 feet long, 8 feet wide, and 4 inches thick.

Procedure:

1. Laying out the foundation:

   a. Pack the sand into 4 small bathroom cups as tightly as possible. Cut 4 straws to a length of 4 inches. Place each 4 inch length of straw into the middle of the sand filled cups and push to the bottom of the cup. Repack your sand to make sure that the straw is secure.

   b. Cut off a piece of string 60 inches long. Loop one end of the string and place it around one of your straws. Measure off 12 inches and loop the string 4 or 5 times around the second straw. Check your measurement to make sure the distance between the first and second straw is exactly 12 inches. **DO NOT CUT THE STRING.**

   c. Measure off 8 more inches of the string and wrap the string around the third straw 4 or 5 times. Once again, be sure to measure the distance between the second and third straw to be exactly 8 inches.

   d. Measure off 12 inches of string and wrap the string around the fourth straw 4 or 5 times. Remeasure the string length between the third and fourth straw to be sure it is exactly 12 inches.

   e. Measure off 8 inches of string and wrap the string around the first straw. Place the cups so that they resemble a rectangle.

   f. Measure 4 inches from straw 1 on the 12 inch side of the rectangle. Mark the string clearly at this point with the felt tip pen. Measure 4 inches from straw 2 on the 12 inch side of the rectangle. Mark the string clearly at this point with the felt tip pen.

g. Measure 3 inches from straw 2 and 3 inches from straw 3 on the 8 inch string. Mark the string clearly at each point also.

h. Measure 4 inches from straw 3 and 4 inches from straw 4 on the 12 inch string and mark each point.

i. Measure 3 inches from straw 4 and 3 inches from straw 1 on the 8 inch string and mark these points.

j. Once again, makc sure that all the string between the straws are the lengths they should be: 12 inches between straws 1 and 2 and between straws 3 and 4; 8 inches between straws 2 and 3 and between straws 4 and 1.

k. Using the "3-4-5 triangle," construct four 90 degree angles (refer to pages 9 and 10 to review this method).

Questions:

1. Measure the diagonals of the "foundation."

   a. Are they equal?

   b. Approximately how long are the diagonals in inches?

   c. According to our "shed," how long should they be?

2. What total length of 3/4 inch thick lumber is needed to build the forms for the foundation? Think about this carefully. Draw a sketch of the foundation below to help you.

3. The roof for the shed is a lean-to (it has only one sloped side). The roof will extend one foot past each edge of the foundation. The high edge of the roof is 2 feet higher than the low side. The roof slopes along the 8 foot dimensions of the foundation. What is the area of the roof?

4. Suppliers sell concrete by the cubic yard. The volume of the slab is the "length times the width times the thickness." How much concrete will be needed for the foundation? (Hint: Be careful of the units)

5. If the concrete supplier charges $125 per cubic yard of concrete, how much will the concrete for the slab cost?

UNIT 7: Working with Shapes in Two Dimensions

LAB ACTIVITY 2: Two Dimensional Geometry

Equipment Needed: Graph paper
Ruler

Problem: Students will determine dimensions of various two-dimensional figures when given the area of the figure. The students will then draw the figures using the dimensions.

I. After using the area given to determine the dimensions draw the following figures on graph paper (l, w, h, etc.). Label the dimensions of each figure and use a dotted line to show the height.

A. Squares:

1. A = 49 sq. units
2. A = 25 sq. units
3. A = 1 sq. units
4. A = 16 sq. units

B. Rectangles:

5. A = 12 sq. units
6. A = 21 sq. units
7. A = 15 sq. units
8. A = 11 sq. units

C. Triangles:

9. A = 7 sq. units
10. A = 12 sq. units
11. A = 3 sq. units
12. A = 9 sq. units

D. Parallelograms:

13. A = 15 sq. units
14. A = 24 sq. units
15. A = 14 sq. units
16. A = 20 sq. units

II. Use the following dimensions to draw each trapezoid. Label each trapezoid with the appropriate dimensions.

E. Trapezoids:

17. $b_1 = 4$, $b_2 = 7$, $h = 3$
18. $b_1 = 5$, $b_2 = 9$, $h = 4$
19. $b_1 = 7$, $b_2 = 5$, $h = 3$
20. $b_1 = 6$, $b_2 = 3$, $h = 2$
21. $b_1 = 5$, $b_2 = 3$, $h = 4$
22. $b_1 = 8$, $b_2 = 6$, $h = 3$

UNIT 7: Working with Shapes in Two Dimensions

LAB ACTIVITY 4: Building a Tropical Garden

Equipment Needed: Measuring tape
Accu-Line drawing kit
Calculator

Problem: The environmental science class is about to begin a project. The class is going to turn the area between the buildings into a tropical garden. In order to keep people from walking through the garden, they need to erect a fence. The area of the garden needs to be calculated so that plants can be ordered. The school has allowed a total of $1,250 for the garden to be constructed. The science class has asked this class to assist in the mathematical calculations for their project to ensure they order correctly and are within their budget.

Procedures:

1. Measure the perimeter. Round your measurements to the nearest 10 feet. (For example, the length of 124' 5" would be rounded to 120 feet.)

2. Use the Accu-line to sketch a drawing of the garden. Use a scale of 1 cm = 10 feet.

3. Calculate the perimeter and the area of the garden. Be sure to write these figures on your drawing.

4. If the science class was to fence the entire garden all the way around, how many feet of fence would be required?

5. Each section of split rail fence requires 2 cross bars and a post. Each cross bar is 10 feet long and costs $2.49. Each end post costs $1.89. How many cross bars and end posts would be needed for the entire fence? (Hint: Remember to consider the length of each side of the garden. You would be wise to label the drawing to show the fence before calculating your answer.)

6. How much would the fence cost?

The science class supplied you with a list of the plants they wish to use in the garden. The costs per plant are as follows:

coconut palms	$39.95
saw palmetto	8.40
lantana	4.79
bayberry trees	42.99

7. If the class wishes to plant 1 coconut palm for each 40 square feet, how many palms should they order?

8. Calculate the cost of 15 lantana plants and 15 saw palmettos.

9. The class wishes to plant 1/4 as many bayberry trees as coconut palms. How many should they order?

10. What is the total cost of plants needed for the proposed garden?

11. What is the total cost of plants and fencing needed for the proposed garden?

12. Is the class operating under the budgeted amount? If so, how much money is left over? If the class is over budget, how much money needs to be cut from the plans?

13. Prepare a list of the materials the science class must buy. Include the number of items, the price per item and the total cost for that item. Show the grand total outlay for the proposed garden on your list and attach this to the sketch you made.

UNIT 7: Working with Shapes in Two Dimensions

LAB ACTIVITY 4: Building a Tropical Garden

Equipment Needed: Measuring tape
Accu-Line drawing kit
Calculator

Problem: The environmental science class is about to begin a project. The class is going to turn the area between the buildings into a tropical garden. In order to keep people from walking through the garden, they need to erect a fence. The area of the garden needs to be calculated so that plants can be ordered. The school has allowed a total of $1,250 for the garden to be constructed. The science class has asked this class to assist in the mathematical calculations for their project to ensure they order correctly and are within their budget.

Procedures:

1. Measure the perimeter. Round your measurements to the nearest 10 feet. (For example, the length of 124' 5" would be rounded to 120 feet.)

2. Use the Accu-line to sketch a drawing of the garden. Use a scale of 1 cm = 10 feet.

3. Calculate the perimeter and the area of the garden. Be sure to write these figures on your drawing.

4. If the science class was to fence the entire garden all the way around, how many feet of fence would be required?

5. Each section of split rail fence requires 2 cross bars and a post. Each cross bar is 10 feet long and costs $2.49. Each end post costs $1.89. How many cross bars and end posts would be needed for the entire fence? (Hint: Remember to consider the length of each side of the garden. You would be wise to label the drawing to show the fence before calculating your answer.)

6. How much would the fence cost?

The science class supplied you with a list of the plants they wish to use in the garden. The costs per plant are as follows:

coconut palms	$39.95
saw palmetto	8.40
lantana	4.79
bayberry trees	42.99

7. If the class wishes to plant 1 coconut palm for each 40 square feet, how many palms should they order?

8. Calculate the cost of 15 lantana plants and 15 saw palmettos.

9. The class wishes to plant 1/4 as many bayberry trees as coconut palms. How many should they order?

10. What is the total cost of plants needed for the proposed garden?

11. What is the total cost of plants and fencing needed for the proposed garden?

12. Is the class operating under the budgeted amount? If so, how much money is left over? If the class is over budget, how much money needs to be cut from the plans?

13. Prepare a list of the materials the science class must buy. Include the number of items, the price per item and the total cost for that item. Show the grand total outlay for the proposed garden on your list and attach this to the sketch you made.

UNIT 7: Working with Shapes in Two Dimensions

LAB ACTIVITY 5: Geometry in Two Dimensions

Equipment Needed: Graph paper
Ruler
Compass

Problem: This activity should be used before formulas are introduced. Students will find area and perimeter of various two dimensional figures by counting squares.

Draw and label the dimensions of the following two-dimensional figures.

A. Three squares that measure:
   1. s = 3
   2. s = 4
   3. s = 5

B. Six rectangles that measure:
   4. l = 8 w = 3
   5. l = 6 w = 4
   6. l = 12 w = 2
   7. l = 9 w = 4
   8. l = 12 w = 3
   9. l = 6 w = 6

C. Four triangles that measure:
   10. b = 5 h = 4
   11. b = 8 h = 3
   12. b = 6 h = 9
   13. b = 4 h = 4

D. Three parallelograms that measure:
   14. b = 6 h = 4
   15. b = 5 h = 8
   16. b = 8 h = 4

E. Three circles that measure:
   17. r = 4
   18. r = 6
   19. r = 5.5

F. Remember to label the dimensions on each drawing.

G. Find the area of each figure above by estimating (counting) how many squares are contained inside the figure. Write the estimated area inside each figure. Label it "A = _____."

H. Find the perimeter of the squares and rectangles only.
Label the perimeter by writing "P = _____" near the figure.

UNIT 8: Working with Shapes in Three Dimensions

LAB ACTIVITY 1: Measuring Classroom

Equipment: Measuring tape
Accu-Line

Problem: You need to measure the dimensions of your classroom to find the wall area, window area and volume of the room.

Procedure:

1. Measure the dimensions of the walls in your classroom. Record your measurements below:

Wall	Length	Width	Height	Area
1				
2				
3				
4				

2. Compute the total wall area for all four walls: _____

3. Measure the dimensions of the windows in your classroom and record the measurements below:

Window	Length	Width	Area
1			
2			
3			

4. Record the total window area: _____.

Calculations:

1. Calculate the total wall area in your classroom to the nearest square foot and subtract the area of the windows. This is the total area of the wall board in your room.

   _____ total wall board area

2. How much paint is needed to cover the walls of the classroom if one gallon covers 300 square feet?

3. Calculate the volume of your classroom. Round you answer to the nearest cubic foot.

   _____ volume of classroom

4. If the air-conditioning system in your classroom moves 800 cubic feet of air per minute, how long will it take to replace the air in your classroom?

5. What effect will a new air-conditioning system have on the time required to replace the air in your classroom if the new unit moves 1,000 cubic feet of air per minute?

UNIT 9: Using Ratios and Proportions

LAB ACTIVITY 1: Ratios and Proportions in Similar Triangles

Equipment Needed: Measuring tape
String
Masking tape
Two 1/4 inch dowel rods of lengths 18" and 36"

Problem: You are to compare the measurements of corresponding triangles.

Procedure:

1. Lay out a large triangle in the classroom using a wall, the floor, and a piece of string to form the sides. Measure a piece of string 10 feet 6 inches long.

2. Measure a distance of 6 feet up from the floor on one wall of the room. Carefully tape the string to the wall at this point. Measure the length of the string that hangs from the wall and mark it at exactly ten feet. Gently stretch the string along the floor until the ten foot mark is reached forming a large triangle with the floor and the wall. Tape the end of the string to the floor. Measure and record the length of all sides of the triangle.

3. Measure the length of the shorter dowel. Position the shorter dowel in the triangle so that the bottom of the dowel forms a 90 degree angle with the floor and the top of the dowel just touches the string. Measure and record the lengths of all three sides of this new triangle.

4. Measure the length of the longer dowel. Position the longer dowel in the triangle so that the bottom of the dowel forms a 90 degree angle with the floor and the top of the dowel just touches the string. Measure and record the lengths of all three sides of this new triangle.

5. Draw one sketch that shows all three triangles and label the length of each side. Use the sketch to complete the following calculations.

Calculations:

Compare the corresponding sides of all three triangles using the data you have collected.

$\frac{\text{Largest triangle}}{\text{Middle triangle}} = \frac{\text{wall}}{\text{dowel}} = _____$ $\frac{\text{string}}{\text{string}} = _____$ $\frac{\text{floor}}{\text{floor}} = _____$

Are the ratios equal? _____
Are the triangles similar? _____

$\frac{\text{Middle triangle}}{\text{Smallest triangle}} = \frac{\text{dowel}}{\text{dowel}} = _____$ $\frac{\text{string}}{\text{string}} = _____$ $\frac{\text{floor}}{\text{floor}} = _____$

Are the ratios equal? _____
Are the triangles similar? _____

$\frac{\text{Largest triangle}}{\text{Smallest triangle}} = \frac{\text{wall}}{\text{dowel}} = _____$ $\frac{\text{string}}{\text{string}} = _____$ $\frac{\text{floor}}{\text{floor}} = _____$

Are the ratios equal? _____
Are the triangles similar? _____

UNIT 9: Using Ratios and Proportions

LAB ACTIVITY 4: Flagpole Height

Equipment Needed: Small mirror
Tape measure
Coin

Problem: You have been challenged by another student to climb to the top of the flagpole at the school. Your friend has stated that he can make the climb in 12 seconds. You had the Physical Education teacher time you in climbing the rope in the gym. The rope was 35 feet high and it took you 10 seconds to make the climb. This means that your climbing rate is _____ per second. You need to estimate the height of the flagpole to see if you can beat the other student before you agree to try. In Applied Math class you have learned that the height can be estimated using ratios and proportions.

Procedure:

1. Have your partner measure your height from the top of your head to the floor. Convert the measurement to feet. (Example: 5 feet 3 inches = 5 3/12 or 5.25 feet)

   I am _____ ft. tall.

2. Next measure the distance from your eye to the floor.

   The distance from my eye to the floor is _____ft.

3. Stand next to the flagpole with your back to the sun. Your partner will measure the length from the middle of your foot to the tip of your shadow. Then measure the length of the shadow formed by the sun hitting the flagpole.

   My shadow length is _____ ft.

   The flagpole shadow length is _____ ft.

4. Place the mirror on the ground 20 feet from the base of the flagpole with the coin in the center. Position yourself so the mirror is directly between you and the flagpole. Back away from the mirror until the top of the flagpole is seen directly on the top of the coin. Measure the distance form the middle of your foot to the coin.

   The coin is _____ ft. from my foot.

Calculations:

1. $\frac{\text{your height}}{\text{flagpole height}} = \frac{\text{your shadow length}}{\text{flagpole shadow length}}$

   $\frac{_____}{x} = _____$

   $x = _____$

2. $\frac{\text{eye to floor height}}{\text{flagpole height}} = \frac{\text{distance from you to coin}}{\text{distance from flagpole to coin}}$

   $\frac{_____}{x} = _____$

   $x = _____$

Questions:

1. Did both proportions yield the same value for the flagpole?

2. Enter on the blackboard chart your values for the height of the flagpole. Calculate the class average for the height of the flagpole for both methods.

   class average for shadow method = _____ ft.

   class average for coin method = _____ ft.

3. Does the class average yield a closer approximation for the flagpole height? Why or why not?

UNIT 9: Using Ratios and Proportions

LAB ACTIVITY 5: Indirect Measurement - Using Ratios and Proportions

Objective: Use indirect measurement by applying the concept of similar triangles with corresponding sides being proportional to determine the height of the stadium lights at the football field.

Equipment: 25 - 30 ft. tape measure
Calculator
Paper and pencil
Lab sheet

1. Draw a sketch below of the stadium light pole, the person, and their shadows. Include a base line to represent the ground. Label using the measurements as follows:

   a. height of _____ = ____ ft. ____ in. = ____ ft.
   (name of person)

   b. length of shadow of named person ____ ft.

   c. time of day: _____ a.m. p.m.

   d. length of shadow of stadium lights _____ ft. (#____)
   (designate which stadium lights - #1 is nearest concession stand and #2 is in the middle)

2. Set up a proportion (using words only) that would solve the problem.

   _____ = _____

3. Now replace the words in the proportion with the measurements taken.
   (Use a question mark to indicate the missing term..

   _____ = _____

4. Solve the proportion to determine the height of the lights.

   Height of stadium lights # ___ = _____ ft.

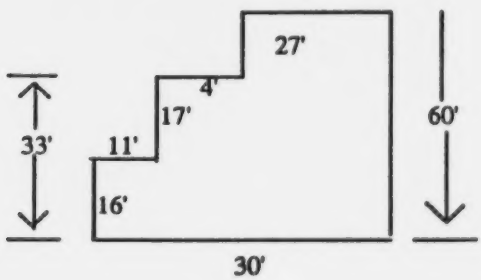
5. Does this measurement seem reasonable? _____ Why? _____

6. Give a logical reason for your answer to #5. _____

UNIT 10: Working with Scale Drawings

LAB ACTIVITY 4: Making a Scale Drawing

Equipment Needed: Ruler
Paper and pencil



We are going to learn how to make a scale drawing by making one! We will use a sketch with actual dimensions, calculate scaled-down dimensions for the drawing, and then draw it.

Listed below are the steps necessary to make a scale drawing. Each step is fully explained. READ IT CAREFULLY. Use centimeters when measuring during this lab. It will make the task easier.

STEP #1 - CHOOSING THE SCALE

To decide on a good scale, you need to know two measurements:

1. The longest measurement of the object you are drawing.
2. The longest line segment you can draw on the paper you are going to use.

Find the Measurements:

1. Look at the sketch drawn above, and find the longest dimension on the sketch.
2. If you are using 8½ x 11 paper, the page size measures about 21cm by 27cm. Leaving ample space for margins and writing on the page, use 15cm as the longest line segment you will draw. The 15cm line segment will represent the 60-foot dimension shown in the sketch.

3. Use the following ratio to choose your scale:
longest line you can fit on your paper : longest dimension you need

_____ : _____ (include units)

_____ : _____ (reduced ratio - first term is one)

STEP #2 - CALCULATING THE LENGTH OF THE LINE SEGMENTS

Before making the drawing, make a table that shows all the dimensions you have. To make this table, choose a starting point, for example, the upper right hand corner of the sketch. As you trace the figure beginning at the starting point, write down each line segment dimension. The table has been set up for you below:

Dimension	Length of line segment on the proposed drawing
60 ft.	15 cm
30 ft.	7.5cm
16 ft.	____cm
11 ft.	____cm
17 ft.	____cm
4 ft.	____cm
27 ft.	____cm
15 ft.	____cm
(and you are back to the starting point)	

Using the scale _____ : _____, calculate the lengths of line segments that will represent those dimensions, and write them in the table.

STEP #3 CONSTRUCTING THE SCALE DRAWING

Beginning with the first dimension in the table, use your ruler to draw the first line at the right side of your paper. In this example, draw a 15-cm vertical line segment at the right side of your paper. Using your 90 triangle, draw a right angle at the bottom of the first line and then measure a 7.5-cm line. Continue drawing right angles and line segments. Follow the design of the sketch, using the line lengths from your table.

Add a key to your drawing to show the scale. Also include the real dimensions on your drawing.

The scale drawing you make will not be similar in shape to the one shown in the sketch because the sketch is not drawn to scale. Your drawing is a more accurate and informative one because it shows the true shape of the object. Your scale drawing is similar to the real object it represents.

Compare your scale drawing to the one in Figure 10-10. If you used the scale given in the directions, your drawing should be the same shape and the same size. Your scale drawing should be congruent to the one in the figure. If you place one over the other, they should match exactly in shape and size.

UNIT 12: Using Scientific Notation

LAB ACTIVITY 2: Calculating Sand Grains

Equipment Needed: Graduated cylinder, 10 ml capacity
Coarse sand, such as cat litter
Micrometer

Problem: You are to count the number of grains of sand in a small volume and use this number to estimate the number of grains of sand in a larger volume. You are also asked to estimate the volume of an average grain of sand.

Procedure:

1. Use the graduated cylinder to measure 1 milliliter of sand. Count the grains of sand in the measured 1 ml.

   Record your answer : _____ grains in 1 ml

2. Based on your count, how many grains of sand would you estimate are in 1 cubic meter? (Remember 1 ml = 1 cubic cm)

   Grains in cubic meter = _____ grain/ml x 100 cm x 100 cm x 100 cm

   = _____ grains

3. Based on your count, how many grains of sand would you estimate are in a strip of beach 1500 meters long by 200 meters wide and 10 centimeters deep? (Hint: Find the volume of the strip of beach, but be careful to observe the units.)

   Volume of the beach = _____

   Grains beach = _____grains/cubic meter x _____ volume

4. Calculate the average volume (in cubic centimeters) of one grain of sand.

   Average Volume = 1 ml ÷ _____ grains in 1 ml

   = _____ cubic centimeters

5. Isolate 5 grains of sand and measure their diameter using the micrometer. Using this information, determine the average measured diameter.

Grain 1 = _____ Grain 4 = _____

Grain 2 = _____ Grain 5 = _____

Grain 3 = _____ Average grain = _____

6. Use the formula $V = 1/6\ \pi\ d^3$ to get an approximate volume for an average grain of sand. Write your answer in scientific notation.

V = 1/6 π _____ cubic inches = _____

7. Using the conversion factor 1 inch = 2.54 centimeters, convert the average diameter of a sand grain to centimeters.

$$\frac{\text{____ inch}}{1} \times \text{_____} = \text{_____ cm}$$

8. Recalculate the approximate volume of the sand grain using the centimeter measure.

V = 1/6 π _____ cubic cm = _____

9. What explanation can you give for the difference between your average volume of a sand grain found in question 4 and the average sand grain answer found in number 8?

FLORIDA TEACHING SUPPLEMENT

APPLIED MATHEMATICS

QUIZZES

UNIT C: Finding Answers with Your Calculator

QUIZ

1. List the five steps that assist you in problem solving:

   Step 1:

   Step 2:

   Step 3:

   Step 4:

   Step 5:

2. Identify two words or phrases that suggest the given mathematical operation.

   a. addition: _____ , _____

   b. subtraction: _____ , _____

   c. multiplication: _____ , _____

   d. division: _____ , _____

3. Use the five steps for problem solving to answer the following problem. Be sure to show clearly each of the steps.

   If one small apple has 78 calories, how many calories are in 6 small apples?

UNIT 2: Estimating Answers

QUIZ

Complete the following table:

Month	Actual Sales	Sales Rounded to the Nearest Ten Thousand	Sales Truncated
January	62,482.25		
February	64,198.56		
March	68,836.45		
April	73,854.91		
May	97,343.49		
June	104,096.74		
July	146,948.49		
August	152,272.09		
September	110,841.16		
October	84,973.80		
November	69,770.98		
December	56,790.91		
Total Sales			

If you were the vice-president in charge of sales for the company, which of the total sales listed above would you accept? Explain why you would accept that total and not the other two.

UNIT 3: Measuring in English and Metric Units

QUIZ

Use conversion ratios to solve the following. Show all work.

1. 7,700 feet to miles

2. 3 tons to pounds

3. 6 quarts to cups

4. 9 inches to feet

5. 9 3/4 inches to feet

6. 0.23 feet to inches

7. 3 liters to gallons

8. 75 milligrams to pounds

9. 8.47 ounces to grams

10. You are running the 100-yard dash. How many meters did you run?

11. You compete in the 100-meter dash. How many yards did you run?

12. A French recipe calls for 1/2 kilogram of butter. How many pounds of butter should you buy?

13. Two towns are 35 miles apart. How many kilometers is this?

14. A sheet of paper is 0.05 milliliters thick. How many inches would 500 sheets of paper be?

15. You are on vacation in Mexico and find that the gas is sold in liters. How many liters would you buy to fill your tank if the tank holds 12 gallons?

UNIT 3: Measuring in English and Metric Units

QUIZ

Write the number that makes the equivalence true:

1. 1 c = _____ tbsp.
2. 1 qt. = _____ pts.
3. 1 mi. = _____ ft.
4. 1 gal. = _____ qts.
5. 1 lb. = _____ oz.
6. 1 tbsp. = _____ tsp.
7. 1 pt. = _____ C.
8. 1 ton = _____ lbs.
9. 1 yd. = _____ ft.
10. 1 C. = _____ oz.

Fill in the missing information:

11. The smallest unit of measure used in the English (or U.S.) System to measure capacity is _____.

12. A liter is approximately _____ _____.

13. One kilogram is approximately _____ pound(s).

14. A _____ weighs approximately one gram.

15. The unit conversion ratio for converting cups to pints would be: $\frac{\text{(unit)}}{\text{(unit)}}$

16. Using a unit conversion ratio, complete the blanks to convert 5000 feet to miles.

$$_____ \text{ (unit)} \; \frac{_____ \text{(unit)}}{\text{(unit)}} = _____ \text{ (unit)} = _____$$

17. Using 1 gal = 3.785 liters, convert 8.1 liters to gallons. Round to the nearest hundredth.

$$_____ \text{ (unit)} \; \frac{_____ \text{(unit)}}{\text{(unit)}} = _____ \text{ (unit)} = _____$$

18. Using the ruler, draw three line segments below that measure the following lengths.

    a. 4 5/8"

    b. 5 1/4"

    c. 7.5 cm

UNIT 5: Dealing with Data

QUIZ

Given: Sue is going to open a store to sell floor covering. She needs to decide what the estimated income might be. Answer the following questions:

1. What additional data does Sue need to solve the problem?

2. What possible sources of information could Sue use to find the data?

3. Describe how Sue might collect the data.

4. Sue reviews the total sales for a floor covering store in a neighboring town over a six month period. She found the following information:

April	-	$1,800
May	-	2,400
June	-	2,600
July	-	2,900
August	-	2,300
September	-	1,500

   Draw a line graph showing the collected data.

5. Using the line graph, make a prediction about the sales in the months of October and November. Explain your answer.

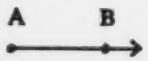
UNIT 6: Working with Lines and Angles

VOCABULARY QUIZ

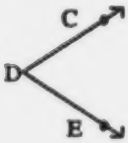
Match the letter of the correct definition with each given word.

____ 1.	line segment	a. the point where two rays come together to form an angle
____ 2.	degree	b. it has no width, no length; it identifies a position in space
____ 3.	diameter	c. an instrument used to measure angles
____ 4.	angle	d. lines that form 90° angles where they cross
____ 5.	circle	e. a line with a fixed point at one end, extending to infinity in the other direction
____ 6.	parallel lines	f. a line segment from the center of a circle to any point on the circle
____ 7.	line	g. it has no width; it extends infinitely in both directions
____ 8.	compass	h. part of a line that extends between two points; the two points are called end points
____ 9.	center of circle	i. a closed curve in two dimensions with all points on the curve at equal distance from a single, enclosed center point
____ 10.	circumference	j. an instrument used to draw circles
____ 11.	vertex of an angle	k. formed by two rays drawn from the same point
____ 12.	ray	l. the distance around a circle
____ 13.	radius	m. a unit of measure for angles
____ 14.	point	n. a line segment beginning on one side of a circle, passing through the center, and ending on the other side of the circle
____ 15.	perpendicular lines	o. equidistant lines in the same plane that never cross
____ 16.	protractor	p. a point inside a circle that is the same distance from all points on the circle

Match the letter of the correct description with the diagram:

___ 17. 

___ 18.

___ 19. 

___ 20.

q. angle CDE

r. ray AB

s. line AB

t. line segment AB

UNIT 7: Working with Shapes in Two Dimensions

QUIZ

Match each shape below with the appropriate definition. Write your answer on the blank provided.

_____ 1. triangle

_____ 2. triangle

_____ 3. trapezoid

_____ 4. circle

_____ 5. right triangle

_____ 6. rectangle

_____ 7. parallelogram

a. closed curve with all points at equal distance from the center point

b. four-sided closed figure with opposite sides equal

c. four-sided closed figure with two opposite sides parallel

d. three-sided figure with three angles

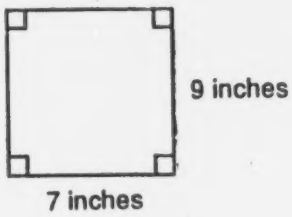
e. three sided figure with one angle equal to 90 degrees

f. four-sided figure with four right angles

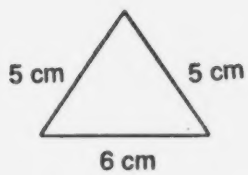
g. four-sided figure with four right angles and four equal sides

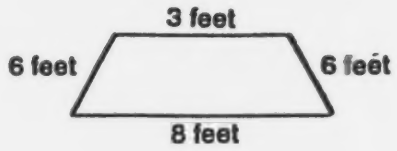
Find the perimeter for each of the following figures

8.



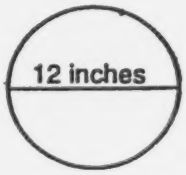
9.

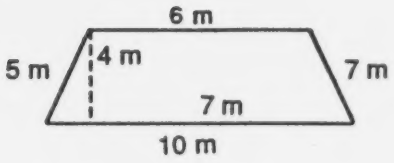


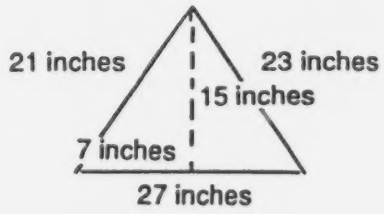
10. 

11. A farmer needs to replace the fence around a horse pasture. The field is rectangular in shape. It measures 100 feet long and 250 feet wide. How many linear feet of fence should the farmer purchase?

Find the area for each of the following figures

12. 

13. 

14. 

15. Mr. Jones wants to purchase sod for his front yard. The yard measures 150 feet by 75 feet. How many square feet of sod should Mr. Jones order?

UNIT 7: Working with Shapes in Two Dimensions

VOCABULARY QUIZ

Match the letter of the definition with the appropriate word.

____ 1. vertex of an angle	a. circumference divided by the diameter; approximate value is 3.14
____ 2. area	b. measure of a line segment that is perpendicular to the base
____ 3. triangle	c. a closed, three-sided figure
____ 4. base	d. the point where two lines meet to form an angle
____ 5. trapezoid	e. a triangle that contains one angle equal to 90°
____ 6. diagonal	f. the distance around the boundary of a closed figure
____ 7. similar triangles	g. a line segment that extends between opposite corners of a closed, four-sided figure
____ 8. right triangle	h. a linear measure along a single direction. Length, width, and height are examples of this.
____ 9. dimension	
____10. rectangle	i. the side or dimension to which the height is perpendicular
____11. height	j. measure of region inside a closed curve. Square units are used.
____12. parallelogram	k. a two-dimensional, four-sided closed figure with only two opposite sides
____13. pi (π)	l. a two-dimensional, four-sided, closed figure with four right angles
____14. perimeter	m. triangles that have the same shape but not the same size. Corresponding angles are equal in measure.
____15. perpendicular distance	
____16. square	n. a two-dimensional, four-sided, closed figure whose opposite sides are parallel and equal in measure
	o. a two-dimensional, closed figure with four equal sides and four right angles
	p. the distance measured along a line segment that is 90° to another line segment. Heights are always measured using this.

UNIT 8: Working with Shapes in Three Dimensions

VOCABULARY QUIZ

Write the letter of the correct definition or description of each vocabulary word.

____ 1. cone

____ 2. hemisphere

____ 3. volume

____ 4. slant height

____ 5. cube

____ 6. rectangular solid

____ 7. base

____ 8. sphere

____ 9. total surface area

____10. cylinder

____11. lateral area

____12. capacity

a. The outside surface area of the sides of three-dimensional figures. It does not include the area of the base(s).

b. A three-dimensional figure with circular bases

c. The area of the total outside surface of a three-dimensional figure

d. A three-dimensional figure formed when a sphere is cut by any plane that contains the center of that sphere. It is half of a sphere.

e. The amount of space that a container encloses. It is measured as volume - by formula or displacement.

f. The distance from a point on the outside of the base to the top of a cone

g. The amount of space enclosed by a three-dimensional figure. It is measured in cubic units.

h. A three-dimensional figure formed when all points on the surface are at an equal distance from given location in space - the center of it

i. A three-dimensional figure whose six faces are rectangularly shaped

j. A geometric figure with six equal faces. Each face is a square. All edges are equal.

k. The bottom, or foundation, that usually supports a three-dimensional figure

l. A three-dimensional figure with a circular base and a pointed top

UNIT 8: Working with Shapes in Three Dimensions

QUIZ 2

FORMULAS: Cylinders

Lateral Area = πdh

Total Surface Area = $\pi dh + 2\pi r^2$

Volume = $\pi r^2 h$

Rectangular Solid

Total Surface Area = $2\,wh + 2\,lh + 2\,lw$

Volume = lwh

Find the lateral area (LA), total surface area (SA), and volume (V) of the cylinders whose measurements are:

1. d = 5 cm
   h = 7.2 cm

   L.A. = S.A. = V =

2. d = 12 in.
   h = 7.5 in.

   L.A. = S.A. = V =

Find the total surface area and the volume of the following rectangular solids:

3. l = 2.5
   w = 5.6
   h = 10

   S.A. = V =

P.S. Don't forget to include the proper units in your final answer.

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UNIT 11: Using Signed Numbers and Vectors

QUIZ

Answer each question below.

1. +47 - (-12) =
2. -12 + (-54) =
3. +73 + (-472) =
4. -79 x +82 =
5. +743 ÷ -12 =

Use the Accu-line to draw the following vectors. Use the scale 1 cm = 10 mph unless otherwise noted. Show the magnitude and directon of all vectors.

6. A ship is traveling south at 45 mph, and it encounters a current flowing west at 20 mph.
7. An airplane is flying east at 75 mph.
8. An airplane flying west at 140 mph encounters a headwind from the west at 25 mph.
9. A sailboat is traveling north at 40 mph. A wind is blowing at 15 mph from a direction which is 20 degrees north of east. (Use the scale 1 cm = 5 mph)
10. Two people are pulling on a rope tied to a stubborn mule. The first person is pulling due east using 15 lbs of force. The other person is pulling at an angle 45 degrees north of east, using a force of 25 lbs. (Use the scale 1 cm = 5 lbs)

UNIT 13: Precision, Accuracy, and Tolerance

QUIZ

Define the following:

1. Accuracy

2. Precision

3. Tolerance interval

4. Exact number

5. Approximate number

6. Error in measurement

Complete the following sentences:

7. The precision of the vernier caliper is _____. The error of measurement is _____.

8. The precision of the micrometer is _____. The error of measurement is _____.

9. The precision of the machinist's rule is _____. The error of measurement is _____

10. A part is to have a width of 1.7 inches ± 0.2 inch. You measure the part to be 2.0 inch. State the upper and lower limits, the tolerance interval, and whether or not this part is acceptable given the specifications.

Upper limit _____

Lower limit _____

Tolerance interval _____

Is this an acceptable part? _____

UNIT 18: Solving Problems That Involve Nonlinear Equations

QUIZ: Hyperbolas

Construct a table for each of the following and then graph the resulting hyperbolas:

1. $y = 3/x$

2. $2xy = 1$

3. $y = \frac{1000}{200x}$

4. The distance from Miami to Jacksonville is 375 miles. The time it takes is the distance divided by the rate. Write the equation and graph the results.

5. $y = 4/x^2$

UNIT 18: Solving Problems That Involve Nonlinear Equations

QUIZ: Parabolas

Construct a table for each equation and then draw the graph using the Accu-Line.

1. $y = 3x^2$

2. $y = -3x^2$

3. $y = -\frac{1}{4}x^2$

4. $y = 4x^2$

Draw the following graphs for problems 5 and 6 on the same set of axes:

5. $y = \frac{1}{2}x^2$, $y = x^2$ and $y = 2x^2$

6. $y = -\frac{1}{2}x^2$, $y = -x^2$ and $y = -2x^2$

7. Describe what happens as the absolute (or positive) value of the coefficient increased in problems 5 and 6.

8. $y = \pm\sqrt{x}$

9. $2y^2 = x$ Hint: solve for y first

10. a. $A = S^2$ is the formula for the area of a square. Graph this equation for $S = 0, \pm1, \pm2, \pm3$.

    b. What can we say about the negative values of S? Does this branch of the parabola give any valid information?

11. $y = 2^x$

UNIT 19: Working with Statistics

QUIZ

Using the data below, find the following:

1. mean $(\bar{x})$ _____
2. mode _____
3. median _____
4. standard deviation (σ) _____
5. draw a histogram

6. range _____
7. Use the mean $(\bar{x})$ and σ to find the upper and lower limits of ± 1 standard deviation of the data. _____
8. What percent of the data fall into the limits determined in question 7?_____

Ages of People Attending a Movie

14	18	30	17
28	18	27	19
37	15	35	18
25	18	27	17
19	19	25	17

FLORIDA TEACHING SUPPLEMENT

APPLIED MATHEMATICS

REVIEW SHEETS

UNIT A: Getting to Know Your Calculator
UNIT B: Naming Number in Different Ways

REVIEW SHEET

Complete all questions below, and label you answers. Round each answer to the nearest thousandth.

1. 1 1/2 cup plus 2 1/4 cup =
2. Write 9/20 as a decimal.
3. $116.16 ÷ 19.36 ft. =
4. 20.0316 - 10.516 =
5. 68 5/8 ÷ 7 5/8 =
6. 17 1/2 yd. ÷ 23 5/9 yd. =
7. $32,131 ÷ 1,397 yd. =
8. 16 2/3 ft. + 3 3/4 ft. =
9. 2,546 lb./day x 365 days =
10. 492.23 gal./day x 34.5 gal./day =
11. 93.05 sec. + 432.5 sec. + 20.73 sec. =
12. Write 27 5/8 as a decimal.
13. 4 3/5 gal. - 3 1/2 gal. =
14. 3/4 gal. ÷ 1/2 day =
15. You get on the scale and find that you weigh 115 lbs. You then pick up a box and find that the scale now says 128 3/4 lbs. How much does the box weigh?
16. You purchase items for $.89, $5.95, $4.72, and $12.95. The tax is $1.20. If you give the clerk a fifty dollar bill, how much change should you get?
17. A store sells pens for $.75 each or a pack of 10 for $6.75. How much money will you save if you buy the package of 10?

18. Write 35% as a decimal.

19. Write .27 as a percent.

20. Write 3/8 as a percent.

21. You have five pencils and you lose two of them. What percent have you lost?

22. Write .375 as a frequently used fraction.

23. Write 9.625 as a fraction in lowest terms.

24. You missed 6 questions on a 20 question test. What fraction of the questions did you miss?

25. 40% of 150 is ____

26. 33% of 93 is ____

27. Five thousand written as a decimal is _____.

28. An item regularly costs $14.70. The sale price is $12.50. What was the rate of discount?

UNIT A: Getting to Know Your Calculator

REVIEW SHEET

Complete the following calculations. Round all answers to three decimal places.

1. 15 x (146,765 - 95,202) = _____
2. (17.875 + 6.5 + 8.25) x 6.69 = _____
3. 4/5 x 7/8 = _____
4. 360/32 = _____
5. 5/25 + 7/56 = _____
6. 12/15 + 5/6 +7/8 = _____
7. 7/64 - 13/128 = _____
8. 7/8 - 1/2 = _____
9. 14/19 - 1/3 = _____
10. 8/15 x 432/72 = _____
11. 5/6 x 1/2 = _____
12. (6.0625 + 3.0015 - 6.064 + 4.02) / (2.34 x 12) = _____
13. 5/8 ÷ 1/2 = _____
14. 3/4 ÷ 5 = _____
15. 9 ÷ 1/2 = _____
16. 4 1/2 + 5 7/8 = _____
17. 1 3/4 + 1 7/25 = _____
18. 9 7/8 - 4 5/6 = _____
19. 7 5/12 x 7 1/2 = _____
20. 10 1/2 x 4 1/3 = _____
21. 1 12/13 ÷ 7 3/8 = _____
22. 5 1/2 ÷ 3 1/3 = _____

Complete the following by stating whether parentheses are needed to complete the operation. Write yes or no.

23. Adding fractions _____
24. Adding mixed numbers _____
25. Subtracting fractions _____
26. Subtracting mixed numbers _____
27. Multiplying fractions _____

28. Multiplying mixed numbers _____

29. Dividing fractions _____

30. Dividing mixed numbers _____

Solve the following problems. Show all work.

31. The Bear Club estimates that 1/3 of the 328 ticket holders will buy popcorn. How many bags of popcorn should they make?

32. If each bag of popcorn costs $0.05 to make and they are sold for $0.50, how much profit will be made on 75 bags?

33. Sarah purchased several items at the store. The prices were $5.75, $1.79, $4.23, $2.20, and $.89. If she pays the cashier with a twenty dollar bill, how much change should she receive?

34. If a dozen eggs cost $1.09, how much is one egg? How much would you pay for eight eggs?

35. Your car has a fifteen-gallon tank. After driving around town, the tank reads 1/8 of a tank. How many gallons do you have left?

36. The bill for lunch was $17.60 for four people. What was each person's share of the bill?

37. If the four people in question 36 decide to leave a tip equal to 1/5 of the bill. What is each person's share of the tip?

38. A large round cake is cut into eight pieces. Ben, John, and Alan agree to split the cost of the cake based on how much they ate. If Ben ate three pieces, how much of the $5.99 does Ben owe?

UNIT 3: Measuring in English and Metric Units

Review Sheet

Write the appropiate conversion ratios:

1. inches to feet

2. grams to ounces

3. yards to meters

4. feet to miles

5. liters to quarts

Compute the following conversions. Show all work.

6. 6 quarts = _____ pints

7. 8 miles = _____ kilometers

8. 5 1/2 cups = _____ pints

9. 4 1/4 cups = _____ milliliters

10. 83 kilograms = _____ pounds

11. 7 quarts = _____ cups

12. 3 1/2 pounds = _____ kilograms

Convert the following metric units:

13. 955 kg = _____ dkg

14. 6 ml = _____ kl

15. 15 hm = _____ cm

16. .054 mm = _____ dm

17. 7.75 l = _____ ml

18. 150,000 mg = _____ hg

19. 349 cm = _____ dkm

20. 0.0785 hl = _____ l

UNIT 20: Working with Probabilities

REVIEW SHEET

Use the following information to answer questions 1, 2 and 3:

A jar contains 100 chips of identical size. Fifteen chips are green, twenty-five are purple, and the remaining ones are white.

1. What percent of the chips are purple?

2. On a single draw, what is the probability of drawing out a green chip?

3. On a single draw, what is the probability of drawing out a non-white chip?

4. A new car dealer advertises 3 different models of a particular car. If each is available in 4 different colors, how many different cars is it possible to order? (Solve this problem by first making a tree diagram and by then using the multiplication rule.)

5. An engineering firm estimates that the probability they will win a bid for a single job is 8 in 12. What are the odds in favor of them winning?

Use the following information to answer questions 6, 7 and 8:

Suppose you have a bowl with coins that you've been collecting. You determine that the bowl contains the following number of coins: 80 pennies, 10 nickels, 15 dimes, and 7 quarters. When you reach into the bowl, without looking, it is equally likely that any one of the coins could be drawn.

6. What is the probability that the coin drawn is a dime?

7. What is the probability that the coin drawn is not a penny?

8. What is the probability that the drawn coin will either be a nickel or a dime?

9. An insurance company groups people according to these categories: male or female; smoker or non-smoker; under 30, between 30 and 60, or over 60. How many different classifications are possible?

10. The call letters that are used to identify TV and radio stations must begin with a W or K. How many sets of different letter combinations are possible if each call name has a total of 4 letters. Assume that any one of the 26 letters in the alphabet can be used for each of the three additional letters.

11. How many different license plate numbers are possible if each number contains 6 digits and each of the 6 digits can contain any of the numbers 0 - 9?

12. How many different seating arrangements are possible for a group of 6 people sitting on a bench?

13. Sue needs to go from her house to the library, the card shop, the grocery store, the gas station and then back home. How many different paths can she follow to complete her errands?

Use the following information to answer questions 14, 15, and 16:

A red flower (with genes RR) is crossed with a white flower (with genes WW). (A flower with RW genes would be a pink flower.)

14. Make a chart to show the possible color combinations of the offspring from this cross.

15. What is the probability of getting a pink flower as an offspring from this cross?

16. What is the probability of getting a white flower from this cross?

17. You toss a coin 5 times and get tails all five times. What is the probability of getting a tail on the sixth toss?

For problems 18 through 20, identify each event as being mutually exclusive or not mutually exclusive.

18. A head and a tail on one toss of a single coin.

19. A person having blue eyes and brown hair.

20. A person owning a stereo and TV.

For problems 21 through 23, identify each pair of events as equally likely or not equally likely.

21. The toss of a coin landing as a head or as a tail.

22. A person owning a Volkswagen or a Ferrari.

23. Winning the lotto or not winning the lotto.

24. What is the probability of an event that has odds of 3 to 2?

25. Can an event have a probability of 2?

FLORIDA TEACHING SUPPLEMENT

APPLIED MATHEMATICS

STUDY GUIDES

UNIT 18: Solving Problems That Involve Nonlinear Equations

STUDY GUIDE

1. Look at the four graphs (a-d) on page 3 and identify the slope for each line.

   a.

   b.

   c.

   d.

2. Identify the y-intercept for each graph on page 3.

   a.

   b.

   c.

   d.

3. How do nonlinear equations differ from linear equations?

   a.

   b.

   c.

   d.

4. How does the graph of a nonlinear equation differ from one of linear equations?

5. List four occupations where nonlinear equations are used.

6. Referring to the four graphs (a-d) on page 5, which part of each formula makes the equation nonlinear?

   a.

   b.

   c.

   d.

7. Given $y = x^2$, complete the table below:

x	$y = x^2$
0	
-1	
+1	
-2	
+2	
-3	
+3	

What happens to the sign when a negative number is squared?

A shorter way to write this table would be:

x	$y = x^2$
0	0
±1	-1
±2	+4
±3	+9

8. Graph $y=x^2$, using the imformation in question 7 table on the previous page. Use a scale of 1 unit = ½ in. (2 boxes) on the Accu-Line.

9. What is this type of curve called?

10. If an equation can be written in the form _____, then its graph will be a parabola.

11. Name 3 real-world examples of parabolic shapes.

    1.
    2.
    3.

12. Complete the table below for $y = \pm\sqrt{x}$

x	$y = \pm\sqrt{x}$
0	
1	
4	+2 and -2 (±2)
9	
12	
16	

13. Using the Accu-Line, the scale, and the graph used in question 8 above, graph the equation in question 2 on the same graph.

14. Given the equation $y = \pm\sqrt{x}$

    $y = \pm\sqrt{x}$

    $y^2 = (\pm\sqrt{x})$

After reading pages 11-15, answer the following questions:

15. What is a reciprocal?

16. How can we use the calculator to find reciprocals?

17. There are many inverse relationships in the real world that follow the general form xy= constant.

    example: Voltage x Current = Electrical Power (constant)

    $V \times I = P$

    so, $V = \frac{P(\text{constant})}{I}$ or $I = \frac{P(\text{constant})}{V}$

    Rate and Time = Distance (constant)

    $R \times T = D$

    Solve for R and T _____

    In either case, when one variable is isolated, the equation becomes

    $x = \frac{\text{constant}}{y}$ or $y = \frac{\text{constant}}{x}$

18. Read the example on page 12 about the dog run. Given the formula A = LW, isolate L.

19. Using the formula in problem 18 above and A = 150 sq. ft., determine the most economical shape (and dimensions) needed to fence the dog run. Begin with W = 1 and solve for L. Sketch a picture of each shape.

    Most economical shape _____

    Lengths = _____

    Width = _____

20. Complete the tables below for the question $y = 1/x$.

x	y = 1/x
¼	
½	
1	
2	
3	
4	

x	y = 1/x
-¼	
-½	
1	
2	
3	
4	

21. Graph the tables in question 20 as two separate curves. Use 1 unit = ½ inch.

22. The graph of $y = 1/x$ in problem 21 is made up of two branches that do not touch each other. Curves like these are called _____.

23. Complete the table below:

Equation	Name of Graph	Quadrants
$y = x^2$		
$y = \pm\sqrt{x}$		
$y = 1/x$		

After reading pages 15 - 19, complete all study activities included in that section of the unit.

After reading pages 19 - 26, complete the following questions:

24. Study the graph provided in example 8, page 19 - 20, about braking distance versus speed on dry concrete. Given the formula $b = 0.05\ 6^{v^2}$, calculate the braking distance needed for speeds of 10, 20, 30, 40, 50, and 60 mph. Graph this data.

25. Describe the difference between your graph and the graph on page 20.

26. Can you explain why we did not include quadrants II, III, IV with negative values in the graph?

27. Referring to example 9, page 21 - 22:

    a. Which variable is the independent variable that will be graphed along the horizontal (or x) axis?

    b. Does it make sense for h to be negative number?

    c. Can B be a negative number?

    d. In which quadrant will this graph be?

28. Given $I = 72/d^2$, answer the following:

    a. Is the relationship between I and d^2 direct or inverse?

    b. When the distance (d) doubles, what happens to the light intensity (I) on the object?

    c. When the distance (d) triples, what happens to the light intensity (I) on the object?

UNIT 19: Working with Statistics

STUDY GUIDE

After you have read pages 3 - 7 of Unit 19, answer the following questions.

1. What is statistics?

2. What is descriptive statistics?

3. Give 3 examples of descriptive statistics?
   1.
   2.
   3.

4. How can descriptive statistics be used?

5. What is inferential statistics?

6. Give 3 examples of inferential statistics.
   1.
   2.
   3.

7. How can inferential statistics be used?

8. Read example 1, pages 6 - 8, carefully. Using the same method described in the example, make a frequency distribution chart of the letters of the alphabet used in the following two sentences:

"These are the times that try men's souls. The summer soldier and the sunshine Patriot will, in this crisis, shrink from the service of their country."

LETTER	FREQ.	%	LETTER	FREQ	%	LETTER	FREQ.	%
A	_____	__	J	_____	__	S	_____	__
B	_____	__	K	_____	__	T	_____	__
C	_____	__	L	_____	__	U	_____	__
D	_____	__	M	_____	__	V	_____	__
E	_____	__	N	_____	__	W	_____	__
F	_____	__	O	_____	__	X	_____	__
G	_____	__	P	_____	__	Y	_____	__
H	_____	__	Q	_____	__	Z	_____	__
I	_____	__	R	_____	__			

FREQUENCY DISTRIBUTION CHART:

9. Use the information in question 8 to complete the study activity on page 9.

   a. Is the percentage of e in your sample of 119 letters more or less than in ordinary English?

   b. What is unusual about the frequency of letters in the sample at the bottom of page 9?

   c. If you had a sample of words that contained 3000 letters, how many letters would you predict to be "n"?

10. Using your own paper, complete both study activities on page 11.

   a. Make frequency distribution tables for Worker B and Worker C in example 2 on page 10.

   b. Use the frequency distribution tables you made in 10a above to find the mode for each worker.

After reading pages 11 through 17, complete the following questions:

11. What is the mode of a set of data?

12. How many modes does each set of data have? Explain!

13. The mode is a useful measure of central tendency to answer what kind of questions?

14. Name 4 questions the mode answers.

15. The median of a set of data is the _____ _____ of the numbers.

16. Does the median have to be one of the actual data values? Explain.

17. To find the median,

18. How do you determine the median of a set of data that has an even number of data values? Explain.

19. Using your frequency distribution tables from question 10 above, determine the median for Worker B and Worker C.

	MODE	MEDIAN
Worker A	____	____
Worker B	____	____
Worker C	____	____

FLORIDA TEACHING SUPPLEMENT

APPLIED MATHEMATICS

VIDEOS

UNIT 5: Dealing with Data

VIDEO

Problem: Schedule the following events into a "fluid" 30-minute radio program from 4:00 p.m. to 4:30 p.m. Use the chart on page 2 of this handout.

Five songs: 2:30 (2 min. 30 sec.), 3:00, 3:30, 4:00, 4:30

News: One 2-minute interval

Sports: One 1-minute interval

Weather: One 1-minute interval

Commercials: Two, each for 1 minute; six, each for 30 seconds

Artist information: Use as needed to fill in slack time

Q-107 jingle: Required near 4:15 p.m. Assume it takes 5 seconds.

Additional constraints: Start the news at the top of the hour and have the weather follow the 4:15 p.m. station break.

To help you get started, answer the following questions:

1. What is the total time for "scheduled" events? _____

2. How much time does that leave for artist information and Q-107 jingle? _____

Use the following format to solve the problem.

TIME	EVENT	LENGTH
4:00:00	News	2:00
4:02:00	Commercial	0:30
4:02:30	Song	3:30
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

When you have finished making your program, how can you check it?

UNIT 18: Solving Problems That Involve NonLinear Equations

VIDEO

Problem: You are asked to determine if the acceleration (a) of the space shuttle is greater than 3g, when g is 32 ft/sec^2.

Equation: $H = vt + 1/2\ at^2$

Where H =

t =

v =

Procedure:

1. Given the formula above, isolate a.

2. Substitute the given values into the equation and solve for a.

3. Determine the value of 3g if g is 32 ft/sec^2.

4. Is the acceleration of the space shuttle greater than 3g?

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FLORIDA TEACHING SUPPLEMENT

APPLIED MATHEMATICS

WORKSHEETS

UNIT A: Getting to Know Your Calculator

WORKSHEET: Fraction Practice Using the Calculator

Complete each problem, rounding answer to hundredths.

1. 4/5 - 11/20 = _____
2. 3 5/6 + 6 7/15 = _____
3. 10/7 × 21/2 = _____
4. 1 1/5 × 4/5 = _____
5. 4/9 ÷ 9/5 = _____
6. 2/3 × 5/6 = _____
7. 7 1/8 - 3 1/5 = _____
8. 7/12 × 8/3 = _____
9. 11/12 ÷ 5/36 = _____
10. 3/8 + 5/12 = _____
11. 5/8 × 3/5 = _____
12. 8/15 ÷ 2/5 = _____
13. 3/4 - 2/5 = _____
14. 3/5 ÷ 1 7/9 = _____
15. 4/3 + 7/5 = _____
16. 2 1/8 × 24 = _____
17. 3 6/7 + 3 1/4 = _____
18. 4/5 - 1/6 = _____
19. 6 1/4 ÷ 5/8 = _____
20. 6 7/20 - 3 3/5 = _____
21. 6 × 5 1/7 = _____
22. 7/12 + 4/9 + 3/4 = _____
23. 3 5/6 + 6 7/15 = _____
24. 1/15 + 1/6 = _____
25. 3 3/10 ÷ 11/15 = _____
26. 5/9 × 1/6 = _____
27. 2 7/10 + 1 1/4 + 8 7/15 = _____
28. 13 1/3 × 15 3/4 = _____
29. 4 3/10 - 1 7/15 = _____
30. 3/4 × 8/11 = _____
31. 2 5/8 × 2/35 = _____
32. 5/9 × 3/10 × 2/3 = _____
33. 6 2/3 + 5 7/8 + 4 5/6 = _____
34. 5 1/4 ÷ 14 = _____
35. 11/12 - 1/4 = _____
36. 16/11 × 33/20 × 5/3 = _____
37. 10 4/5 ÷ 2 2/11 = _____
38. 11 ÷ 7 1/2 = _____
39. 2 × 3 5/6 = _____
40. 13/24 - (3/8 - 5/18) = _____

UNIT 3: Measuring in English and Metric Units

WORKSHEET 1: English Units Conversion

Write the conversion ratio(s) needed.

1. inches to feet — 1. _____
2. feet to miles — 2. _____
3. pounds to ounces — 3. _____
4. ounces to cups — 4. _____
5. pints to quarts — 5. _____
6. quarts to cups — 6. _____ x _____
7. tons to ounces — 7. _____ x _____

Compute the following conversions. Show all work.

8. 6 quarts = ____ pints — 8. _____
9. 35 ounces = ____ quarts — 9. _____
10. 10,56[illegible]et = ____ miles — 10. _____
11. 8 ounces = ____ tablespoons — 11. _____
12. 3 quarts = ____ cups — 12. _____
13. 7 miles = ____ yards — 13. _____
14. 6 gallons = ____ pints — 14. _____
15. 12.4 teaspoons = ____ pints — 15. _____

UNIT 3: Measuring in English and Metric Units

WORKSHEET 2: Metric and English Measurement

Write a conversion ratio for each of the following:

1. feet to miles 1. _____
2. cups to ounces 2. _____
3. ounces to pounds 3. _____
4. feet to yards 4. _____
5. meters to yards 5. _____
6. pounds to kilograms 6. _____
7. quarts to liters 7. _____
8. teaspoons to milliliters 8. _____
9. feet to centimeters 9. _____
10. milliliters to cups 10. _____

Calculate the following:

11. 17.35 km = ___ m 11. _____
12. 34.83 kg = ___ g 12. _____
13. 0.075 hl = ___ L 13. _____
14. 15 L = ___ ml 14. _____
15. 4.35 dg = ___ hg 15. _____
16. 7 cm = ___ km 16. _____
17. 50,281 mg = ___ g 17. _____

18. 358 ml = ___ cl 18. _____

19. 0.432 kg = ___ dkg 19. _____

20. 43 g = ___ mg 20. _____

Solve the following by using a conversion ratio. Show all work.

21. 17.35 km to miles

22. 15 liters to quarts

23. 5804 yards to feet

24. 156 feet to inches

25. 12.75 gallons to liters

UNIT 11: Using Signed Numbers and Vectors

WORKSHEET 1: Vectors

Equipment Needed: Protractor
Accu-Line
Ruler

Draw the following vectors on the Accu-line. Be sure to label each vector completely, and show an appropriate scale for each vector drawing.

1. An airplane flying east with an air speed of 235 mph.

   a. What scale did you choose?

   b. How many vectors did you draw?

2. An airplane flying west with an air speed of 115 mph encounters a tail wind (from the east) of 25 mph. Draw and label the resultant.

   a. What scale did you choose?

   b. How many vectors did you draw?

   c. What is the magnitude of the resultant?

   d. What is the direction of the resultant?

3. An airplane flying east with an indicated air speed of 140 mph encounters a headwind (from the east) of 15 mph. Show where the plane actually flies.

   a. What scale did you choose?

   b. How many vectors did you draw?

   c. What is the magnitude of the resultant?

   d. What is the direction of the resultant?

4. The ground speed and direction of an airplane flying east with an air speed of 140 encounters a wind blowing from the south at 35 mph.

   a. What scale did you choose?

   b. How many vectors did you draw?

   c. What is the magnitude of the resultant?

   d. What is the direction of the resultant?

5. Two people are pulling on an object with a rope. One person is pulling due east with a magnitude of 50 lbs. The other person is pulling at an angle of 45 degrees north of east using 30 lbs. of force. Draw the resultant vector.

   a. What scale did you choose?

   b. How many vectors did you draw?

   c. What is the magnitude of the resultant?

   d. What is the direction of the resultant?

UNIT 11: Using Signed Numbers and Vectors

WORKSHEET 2: Signed Numbers and Vectors

Draw a picture of the situations described below. Choose your own scale and label each problem completely.

1. An airplane is flying east with an air speed of 235 mph.

2. An airplane flying east with an indicated air speed of 115 mph encounters a tail wind (from the east) of 25 mph.

3. An airplane flying east with an indicated air speed of 140 mph encounters a head wind (from the east) of 15 mph.

4. The airplane is flying north with an air speed of 140 mph. It encounters a wind blowing from the south at 35 mph.

5. Two people are pulling on an object with a rope. One person is pulling due east with a magnitude of 50 lbs. while the other person is pulling at a 40 degree angle north of east using 30 lbs. of force.

6. A man parachutes from a plane. He intends to fall straight down, but there is a wind blowing from the east at 15 mph. The man's velocity as he falls is 75 mph.

7. A ship is sailing due south at 20 mph. The ship is moving through a current in the ocean that flows in a direction that is 20 degrees north of east at 10 mph.

UNIT 15: Using Formulas to Solve Practical Problems

WORKSHEET 1: Solving Problems with Formulas

Solve the formula for the given variable:

1. $P = 2L + 2W$ Solve for L

2. $V = \pi r^2 h$ Solve for h

3. $A = 1/2\ b\ h$ Solve for b

4. $C = 2\ \pi\ r$ Solve for r

5. $V = \pi r^2 h$ Solve for r

6. $I = P\ R\ T$ Solve for T

Show all formulas and work when solving these problems:

7. The loft door on a barn is 14 feet above the ground. A conveyor belt is used to load hay into the loft. The conveyor belt is 25 feet long. How far away from the barn should you place the conveyor belt? (Hint: draw a picture first).

8. A rectangular room is 120 square feet. The length is 15 feet. What is the width?

UNIT 19: Working with Statistics

WORKSHEET

Define each of the following terms:

1. mean
2. median
3. mode
4. range
5. standard deviation
6. What are the measures of central tendency?
7. What are the measures of variability?

8. Given the test scores for a class of 30listed on the next page, calculate the following:
   a. $\bar{x}$
   b. mode
   c. median
   d. σ
   e. draw a histogram
   f. Does the data fit a normal curve?
   g. What is the range of the data?

Hint: Begin by making a frequency distribution. You may want to put the data into intervals.

Test Scores:

97	97	78	70	63
87	76	94	70	67
88	91	67	90	40
91	69	84	59	82
75	86	64	90	87
81	87	48	90	96

9. Use the standard deviation and the mean to determine lower and upper limits of 1 standard deviation from the mean. What are those limits?

10. What percent of the data members fall in this range?

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